SP200/210

Service Manual

maxon®

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AMENDMENT RECORD SHEET

All amendments to this manual should be incorporated as soon as they are received and recorded below:

Issue No.	Effective Date	Reason for Change	Date	Signature

All Engineering Bulletins relevant to this product should be placed at the rear of this binder. Please ensure that this manual is updated with any replacement pages, which may accompany these Engineering Bulletins. Always read all Engineering Bulletins before carrying out work on a radio.

Please read the WARNINGS on the next page before referring to subsequent sections.

WARNINGS

- **Components containing beryllium oxide are used in the equipment. Dust from this material is a health hazard if inhaled or allowed to come into contact with the skin. Great care must be taken when handling these components. They must not be broken or subjected to excessive heat.**
- **Never operate the radio transmitter without the correct Maxon antenna, or a suitable artificial load, connected.**
- **Never modify a radio, or accessory, except as instructed in the Service Manual, Engineering Bulletins or formal communication as this may invalidate any warranty, guarantee or type approval.**
- **Do not operate this equipment in environments containing explosive materials or vapour.**

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1 INTRODUCTION

This Maxon Service Manual is a comprehensive guide to the maintenance and field repair of this equipment. It covers a number of versions of the SP200/210 radio and its accessories. Differences between the versions are indicated, as appropriate, in the text.

Before using this manual please read the whole of this introductory chapter, this will help you to make the best use of it. If you have not done so already, please also read the warnings on page ii before proceeding any further.

The range of SP200/210 radios is as follows:

SP200/210 199 fixed channel, (V2) VHF or (U2) UHF radio.

1.1 Using this Manual

At any one time you will need to refer to only a small part of the manual. It has been organised as follows to make this as easy and as quick as possible.

Chapter 2 - Specification, gives the detailed specification.

Chapter 3 - Accessories and Options. Lists the Accessories and Options that are available.

Chapter 4 - Installation, Commissioning & Alignment. Describes connections to the radio, how to commission it and how to Align the radio should this becomes necessary. You will also find it helpful to read the operating instructions in the User Manual and Chapter 7 on Programming.

Chapter 5 - Detailed Functional Description.

Chapter 6 - Troubleshooting and PCB Drawings.

Chapter 7 - Programming.

Chapter 8 - Exploded Mechanical Drawings and Parts Lists.

Chapter 9 - Circuit Diagrams and PCB Layouts.

Chapter 10 - Spare Parts & Maintenance Policy.

Chapter 11 – ACC-2003 Alignment Box

1.2 Amendments to this Manual

From time to time during its lifetime this product will be changed and improved. To cover such changes, amendments to this manual will be issued in the form of replacement and/or additional pages. It is important that anyone working on a product has all the relevant information. Therefore you should incorporate amendments to this manual on receipt. Please follow the instructions accompanying the amendment (in the form of an Engineering Bulletin) and be sure to complete the amendment record at the front of this manual.

On occasion it may be necessary to issue product information more quickly than can be achieved with an amendment. In this case the information will be distributed as an Engineering Bulletin. Engineering Bulletin numbers are prefixed with a category letter – A, B or C. e.g.,

CATEGORY C - ENGINEERING BULLETIN 120

Category definitions are:

'A' Category A Engineering Bulletins will only be released if, by using the equipment manufactured by Maxon or its subcontractors, a risk to operator safety or an infringement of Type Approval is probable.

All units affected should be returned for modification to Maxon Europe Works Department on receipt of such a Bulletin.

'B' Category B Engineering Bulletins are for equipment manufactured by Maxon that may have component batch problems.

All equipment's affected, that are in service, are to be returned to the Distributor or Dealer workshop for modification. Maxon will supply replacement components free of charge.

'C' Category C Engineering Bulletins are for improvement or modification to equipment manufactured by Maxon.

Dealer/Distributor to modify affected units in the field on the next service call. Maxon will supply components free of charge.

Please place these at the back of this manual and refer to them before carrying out any work. This Service Manual should be updated with any accompanying replacement pages. You may wish to retain the previous issue pages for future reference.

1.3 Contact Information

Should you have any queries regarding this manual, or the information within it, please contact:

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2 SPECIFICATIONS

2.1 General

Performance Specifications	R&TTE Appendix IV CE 168 △ ETS 300.086 Jan 91 I-ETS 300 219 Oct 93 ETS 300 279 Feb 96 TIA/EIA-603	
Band	VHF 146 – 174MHz (V2) UHF 440 – 470MHz (U2)	
Channel Spacing	12.5kHz or 25kHz Channel spacing is programmable.	
RF Output Power	1W / 5W (programmable and variable)	
Modulation Type	G3E	
Audio Power	1W (Internal 4 Ω speaker) 500mW (External 8Ω speaker),	
Intermediate Frequencies	45.1MHz First I.F., 455kHz Second I.F.	
Number of Channels	199	
Switching Range (without retuning)	V2 146 to 174MHz Rx 146 to 174MHz Tx U2 440 to 470MHz Rx 440 to 470MHz Tx	
Frequency Source	Synthesiser	
Operation Rating	Intermittent 90:5:5 (STBY:RX:TX)	
Power Supply	7.5Vdc nominal	
Current Consumption	Standby (muted) with battery save on Standby (muted) with battery save off Unmuted with 100% AF power Transmit @ 5W RF output	<40mA <80mA <250mA <2.4A
Battery Life (minimum) All figures stated with Power Save On	1350mAH	>8.5Hrs

Environmental

Operating Temperature Range	-15 to +35°C (nominal) -20 to +55°C (extreme),
Storage Temperature Range	-40 to +80°C (storage)
Charging Temperature Range	0 to +30°C
Humidity	EIA/TIA 603 (95%)
Protection against ingress of dust and water	IEC 529 IP54
Vibration	BS2011 : Part 2.1Fc IEC 68-2-6 Part 2.1Fd IEC 68-2-34
Robustness	Mil Std 810 C Procedures I, II & V
ESD	20kV (C-MIC >= 15kV)
EMC	EMC Directive 89/336/EEC May 89
Physical Dimensions	112 x 61 x 40mm (Excluding antenna and with QPA1350 pack)

Synthesiser

Reference Crystal	
Frequency:	12.8MHz
Holder:	HC-18
Accuracy:	± 3ppm over –30 to +60°C
Ageing Rate:	< 2ppm / Year in the first year < 1ppm / Year in subsequent years
Synthesiser Lock Time:	< 10mS
Switching Times	
Tx to Rx, same frequency	< 20mS
Rx to Tx, same frequency	< 20mS
Rx to Rx (over switching bandwidth)	< 20mS
Rx to Tx / Tx to Rx (over switching bandwidth)	< 20mS
Receiver Sensitivity	<-118dBm (VHF), <-117dBm (UHF)
Squelch Sensitivity	7 – 12dB SINAD
Adjacent Channel Selectivity	Better than 70dB

Sub Audio Tones – CTCSS / DCS

Decode Sensitivity Method (decrease signal level @ 10% peak deviation)

All tones	<=9dB SINAD
CTCSS Tone Range	67 – 250Hz @ 0.3% accuracy 50 – 260Hz @ 0.3% accuracy (non-standard tones)
DCS Tone Standard	Standard & Inverted
Programmer	SMP 6100

3 ACCESSORIES & OPTIONS

3.1 Pre-Install Check

The SP200/210, as purchased, is supplied with an Antenna, charger and power supply, belt clip and User Manual.

3.2 Accessories

A wide range of accessories are available for the SP200/210. The list below represents a summary of accessories available at the time this manual was published. For up-to-date listings, and for price and availability, please refer to the current Price Book.

Order Code	Description
Batteries	
QPA-1350	1350mAh NimH battery.
Chargers	
QPA-1185-2	2-pin (European) Intelligent fast charger with mains adapter
QPA-1185-3	3-pin (UK) Intelligent fast charger with mains adapter
QPA-1185	Spare cup for the above chargers (No PSU)
QPA-1195-2	6 + 6 Intelligent fast charger (Euro)
QPA-1195-3	6 + 6 Intelligent fast charger (UK)
CA1246	In-car charger
Speaker / Microphone accessories	
MA100-01	Small Remote speaker mic.
MA100-02	Standard Remote speaker mic.
Headset Accessories	
HS100-02	Lightweight headset
QPA1432	Lightweight headset
QPA1433	Two-way covert kit
QPA1455	Earbud
HS100-01	Earbud with Earhanger
Cases	
CA1487	Lightweight Nylon case.
CA1475	Soft Leather case
CA1476	Soft Leather case with window
CA-7059	Belt Clip
Programmer	
SMP6100	SP200/210 Programming Kit

3.3 Options

None

4 INSTALLATION, COMMISSIONING & ALIGNMENT

4.1 Installation

The SP200/210 is a hand-held radio and thus requires no installation.

The User should ensure that the batteries are charged before commencing commissioning tests.

4.2 Connections

1. Antenna connector: socket.
2. Channel Busy / Talk tri-colour LED.
3. Display
4. Main Power switch and volume control. Fully anti-clockwise is the OFF position.
5. Battery Release Catch.
6. Speaker.
7. Push To Talk (PTT) button.
8. Microphone.
9. Scan button.
10. Monitor button (unmutes the radio).
11. Channel select keys: Up / Down keys, used to select channels.
12. Accessories socket (microphone & speaker)

Note: Socket 12 is the Accessories Connector, which may be used to connect the radio to the following:

An optional remote speaker / microphone
An optional headset
A PC for programming using SMP6100software

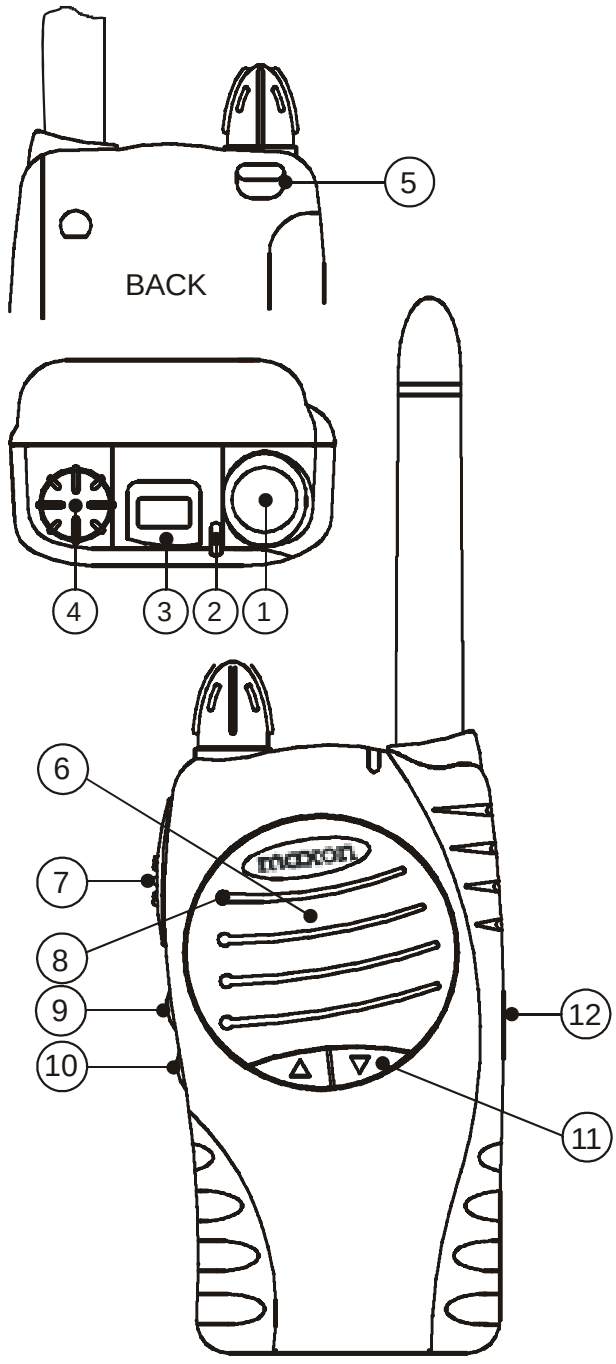


Figure 4-1 - Connections and controls

The Accessory connector is wired as follows:

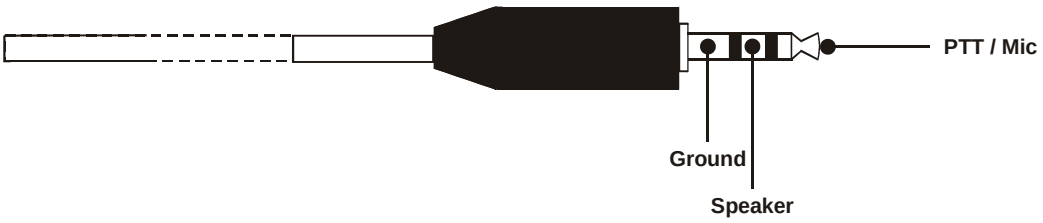


Figure 4-2 – Connections

The small multi-pin connector, which is connected to the other end of the test lead, is wired as follows:

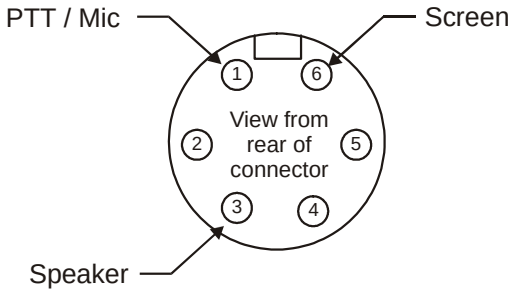


Figure 4-3 - Hirose connector

4.3 Commissioning

This section covers the tests, which should be undertaken prior to handover of the radio to the end user. All of the following tests can be carried out without having to gain access to the interior of the radio.

Recommended Test Equipment

The alignment and performance test procedures assume the use of the following equipment. The functions of most of the equipment may be found in a “Communications Test Set”. This type of equipment is available from a number of test equipment manufacturers.

Throughout this book reference will be made to the use of the Communications Test Set. Where applicable, the equivalent discrete item of test equipment may be used.

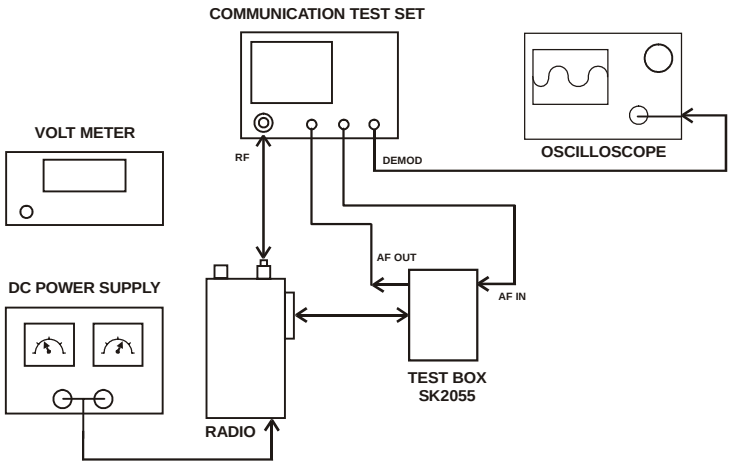


Figure 4-4 – Commissioning Test Setup using SK2055 Service Kit

Commissioning Equipment

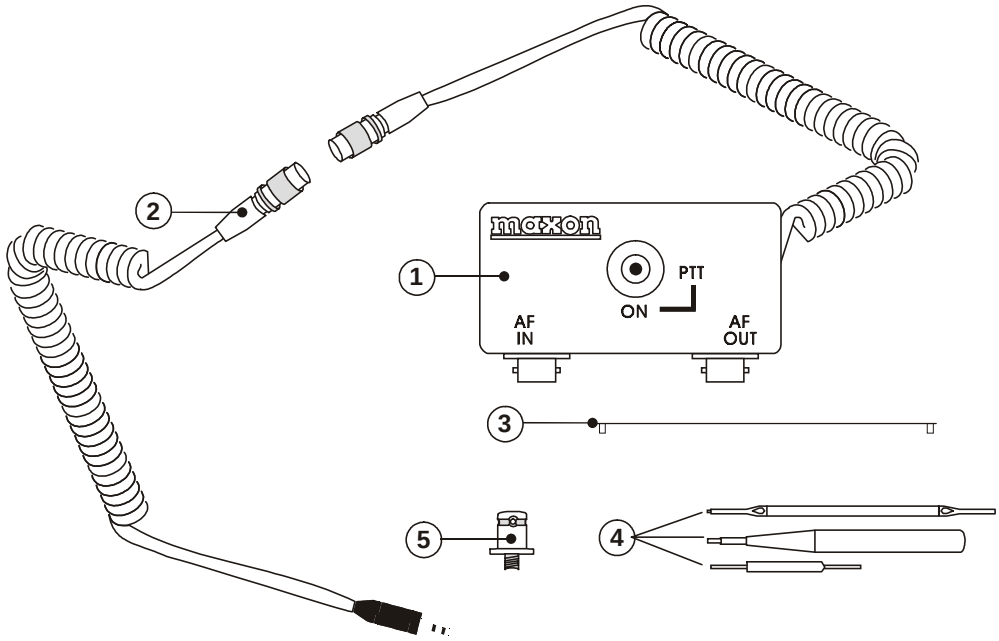


Figure 4-5 – Commissioning Kit

Note: For those dealers who already have the SK2055 Service Kit (SL25/55) the audio cable (2), CA8700, may be purchased. This interfaces the Service Kit to the SP200/210 and allows all simple, commissioning audio measurements to be made. SMA adapter (5), ME210089 will also be required. Flexi-pcb (3), ME110016 may be required if simple internal adjustments are to be made.

Note: The equipment shown in Figure 4-5 allows only VCO and power adjustments to be made to the SP200/210. The full Service Kit, SK3100, is required for setting deviation.

Please refer to Figure 4-6 for the set-up using discrete test equipment and Figure 4-4 for the set-up using the Communications Test Set. If the ACC-2003 Interface Box is used, please refer to Figure 4-7.

Discrete Test Equipment

RF Signal Generator (with CTCSS/1kHz tone)
RF Power Meter
RF Frequency Counter
Spectrum Analyser and notch filter (optional)
Audio Signal Generator
Audio Power Meter
SINAD Meter
Modulation Meter
Oscilloscope
Voltmeter
DC Power Supply, 0 - 10V 3A min.

Combined Equipment
Communications Test Set (e.g. Marconi TF2955, Stabilock 4015 or similar).

Accessories

ME210089 SMA to BNC Adapter.
CA8700 Audio Lead for use with SK2055 Service Kit to perform audio measurements.
SK3100 Service Kit
ACC-2002 SL100 Programming Lead

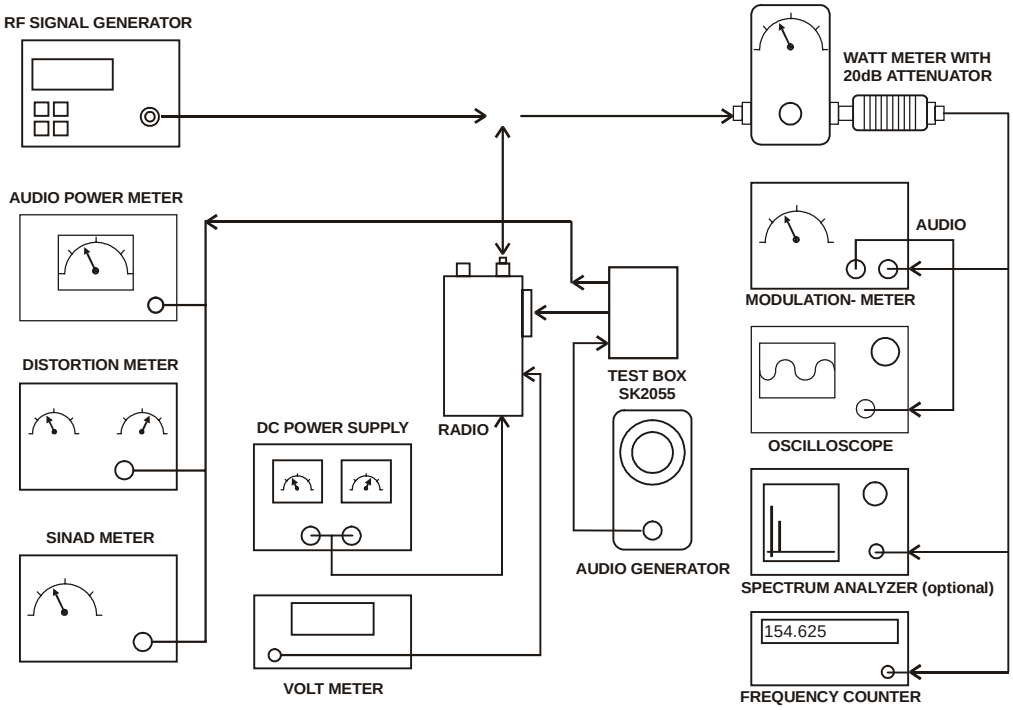


Figure 4-6 – Test Equipment Set-up using Discrete Test Equipment

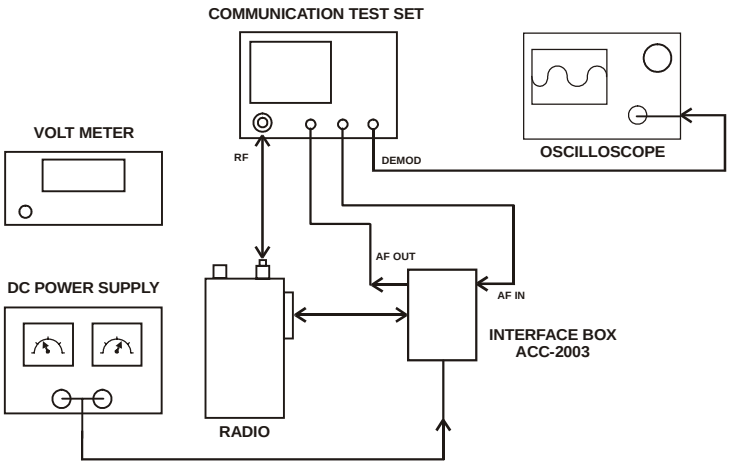


Figure 4-7 – Test Equipment Set-up using a Communications Test Set

SK 3100 Service Kit

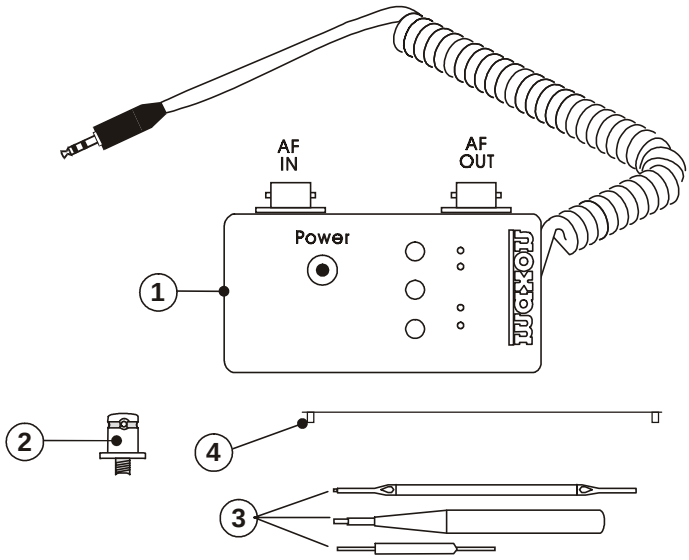


Figure 4-8 - SK 3100 Service Kit

This kit can be used for commissioning in the same way as the SK2055 (ignoring computer connections). The above kit also includes a battery eliminator.

Note: If the Interface Box is used, ensure that it is set to manual, Audio enable is off and PTT is off before powering up.

If programming the radio with the Battery eliminator connected, the curly cord must be disconnected from the Interface Box.

The SK 3100 service kit is used with the SP200/210 radio and provides most of the interface cables and tools which will be required for test and alignment of the SP200/210.

The SK 3100 Service Kit **does not** provide the programming cable, ACC-2002. This is available as part of the SMP6100 Programming Kit (see Section 3).

1. ACC-2003 Radio Interface Test Box. This provides an audio interface, a battery eliminator / programming interface and a PTT switch.
2. ME210089 SMA to BNC Adapter
3. Trimmer Tools. These are used to adjust the trimmers and ferrite cores within the radio.
4. ME110016 Flexi-PCB. Used to interconnect the Digital and RF pcbs for servicing.

Prerequisites
For the following tests, signal generator modulation level should be set to Average System Deviation, i.e. 60% of maximum system deviation.

The level should therefore be set to:

1.5 kHz for 12.5 kHz channel spacing
2.4 kHz for 20 kHz channel spacing
3.0 kHz for 25 kHz channel spacing

If the radio has had components installed to change the channel spacing and/or operating band from those installed at the factory, ensure that the correct components are installed in the receiver and transmitter stages prior to testing.

Refer to the appropriate Electrical Parts List if necessary.

EEPROM programming

Ensure that the radio has the required customer parameters programmed, otherwise ensure that the radio is programmed with at least the lowest, middle and highest Rx/Tx frequencies prior to aligning the VHF and UHF scanning handheld series radio.

Ensure that High and Low power are programmed.

When CTCSS and DCS performance checks are also required, ensure that the lowest, middle and highest Rx/Tx frequencies include:

Lowest Rx/Tx freq. ch. 67.0 Hz CTCSS
Middle Rx/Tx freq. ch. DCS Code 072
Highest Rx/Tx freq. ch. 250.3 Hz CTCSS

The middle Rx/Tx frequencies should be halfway between the lowest and the highest frequencies.

Programming details are given in Section 7.

4.3.1 Test Equipment Connection

Use a battery or connect the power supply leads from the battery eliminator to the power supply. The red, positive, lead connects to +7.5Vdc. The black, negative, lead connects to the negative, terminal of the power supply.

A connection diagrams are given in Figures 4-4, 4-6 or 4-7.

Set the radio to a channel with High power.

4.3.2 Transmitter Performance Tests

Power Output

This test is only possible using the battery eliminator.

a. Connect the transmitter to the Communications Test Set (CTS).

b. Set the power supply to 7.5Vdc and connect a dc voltmeter across the power supply to monitor the supply voltage.

c. Set the CTS to the same frequency as the radio. Activate PTT. Check and record the power output. The nominal power output is 5W ± 1.5dB (3.5 to 7W)

d. Reduce the power supply voltage to 6.0Vdc and PTT. The output power should be greater than 50% of the level measured above.

e. Switch to a channel with a low power and ensure that the nominal power is 1W ± 1.5dB.

Frequency Error

a. Check that the transmit frequency is within +/- 500Hz (VHF) or +/- 750Hz (UHF) of the frequency which is programmed into the radio.

Deviation and Distortion

a. Set the radio to the middle Tx frequency.
b. Set the audio signal generator to 1kHz tone, low output impedance PTT and adjust the AF generator level for 60% system deviation:

12.5kHz channel spacing	1.5kHz dev.
20kHz channel spacing	2.4kHz dev.
25kHz channel spacing	3kHz dev.

c. Measure the audio distortion. This should be less than 5%.

d. Increase the audio signal generator level by 20dB (10x voltage). The peak deviation should be:

12.5kHz channel spacing	<= 2.25kHz dev.
20kHz channel spacing	<= 3.6kHz dev.
25kHz channel spacing	<= 4.5kHz dev.

4.3.3 Receiver Performance Tests

Sensitivity

The SINAD performance test may be used to test the sensitivity of the receiver.

a. Connect the Communications Test Set, modulated with a 1kHz tone, to the radio.

b. Set the frequency to correspond to the Rx frequency of one of the channels programmed into the radio.

c. Using the Test Box, ensure that the AF output from the Interface Box is connected to the CTS SINAD meter.

d. Set the volume control to mid-range.

e. Set the Test Set deviation to:

12.5kHz channel spacing	1.5kHz dev.
20kHz channel spacing	2.4kHz dev.
25kHz channel spacing	3kHz dev.

f. Adjust the RF signal generator level until the SINAD meter reads 12dB.

g. Check that the signal generator RF level is < -117dBm (UHF) or < -118dBm (VHF).

Squelch

a. Ensure that both the radio and the Test Set are set to the appropriate channel spacing.

b. With the above setting, reduce the RF level to –130dBm. The radio should be mute.

c. Adjust the RF level until the SINAD meter reads 10dB. The radio should unmute. (**Note**: it will be necessary to press and hold the monitor button to read < 10dB SINAD).

Audio Output

a. Set the RF signal generator to 1mV pd (-47.0dBm) and the tone and deviation as above.

b. Connect the audio power meter to the external accessories socket on the radio, via the test box.

c. Adjust the volume control on the radio under test to maximum (fully clockwise). The voltmeter should indicate >= 1.55V. The audio power meter should read >= 300mW.

d. Decrease the volume control on the radio so that the voltmeter reads 1.0V. Check that the audio distortion is <5%.

Note: The audio power meter should be set to 8Ω.

This concludes the Performance Tests.

If the Radio should fail any of these tests it will be necessary to turn to the next section on Alignment.

4.4 Power Adjustment

Note: Any power adjustments made should be within R&TTE parameters.

Transmit periods longer than 5 minutes are to be avoided.
Power setting potentiometers are located underneath the upper label on the back of the radio. A replacement label is shipped with every radio.

This section is included here as it is not necessary to disassemble the radio in order to set the power output.

A stable power source is required and therefore the ACC-2003 Interface Box should be used as this contains a battery eliminator.

For squelch adjustments, see Section 4.5.6.

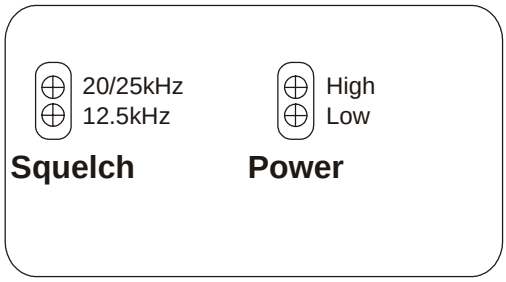


Figure 4-9 - Back Panel Adjusters

a. Select a mid-frequency channel with High Power.

b. Set the PTT switch to on.

c. Adjust RV1 (High) to give 5W ± 0.1W.

d. Set the PTT switch to off.

e. Select a mid-frequency channel with Low Power.

f. Set the PTT switch to on.

g. Adjust RV3 (Low) to give 1W ± 0.1W.

h. Set the PTT switch to off.

i. Repeat steps a to h until switching between the two channels gives Low Power of 1W and High Power of 5W.

j. Switch to a low frequency, low power channel.

k. Set the PTT switch to on.

l. Check that the power output is 1W ± 1.5dB (0.7 to 1.41W).

m. Set the PTT switch to off.

n. Repeat steps k to m for a low power, high frequency channel.

4.5 Alignment

CAUTION

This radio contains static sensitive devices. Static safe precautions should be observed, in particular we would recommend the use of a suitable floor mat, table mat, bonding cords and a wrist strap. The soldering iron should have an earthed tip.

Care should be exercised in the handling of static sensitive components and they should always be transported in the correct containers.

Never remove, or insert, static sensitive devices with the power applied.

4.5.1 Preparation

To perform the following tests it is necessary to program the radio as follows:

VHF

Ch.	Tx(MHz)	Rx(MHz)	CTCSS
1	146.025	146.025	None
2	160.025	160.025	None
3	173.975	173.975	None
4	173.975	173.975	67Hz
5	173.975	173.975	250.3
6	146.025	146.025	None
7	160.025	160.025	None
8	173.975	173.975	None
9	173.975	173.975	67Hz
10	173.975	173.975	250.3

UHF

Ch.	Tx(MHz)	Rx(MHz)	CTCSS
1	440.025	440.025	None
2	455.025	455.025	None
3	469.975	469.975	None
4	469.975	469.975	67Hz
5	469.975	469.975	250.3
6	440.025	440.025	None
7	455.025	455.025	None
8	469.975	469.975	None
9	469.975	469.975	67Hz
10	469.975	469.975	250.3

Channel spacing as required. Channels 1 to 5 should be set to Low Power and channels 6 to 10 set to High Power.

Ensure that the Power Save is OFF.

Tests without Disassembly

Power Output, Deviation, Balance and Squelch adjustment do not require the radio to be disassembled.

4.5.2 Disassembly and Re-assembly of the Radio

Radio

In order to carry out the following PLL and Alignment procedures it will be necessary to gain access to the inside of the radio.

Care should be exercised when opening up the radio for maintenance or repair.

REMOVING AND REPLACING THE BATTERY

Removal

Holding the radio chassis in one hand, press and hold the battery release catch (1) on the top of the battery pack.

Using the other hand, slide the battery down, towards the bottom of the radio and off the battery guide rail (2).

Replacement

With the slides of the battery positioned in line with the radio battery rail guides, slide the battery into position until a click is heard.

REMOVING AND REPLACING THE BELT CLIP

Removal

Lift the locking lever (3) located on the top of the belt clip with one hand and pull the belt clip out of the belt clip rail towards the battery / radio top.

Replacement

With the slides of the belt clip positioned in line with the belt clip rail guides, slide the belt clip into position until a click is heard.

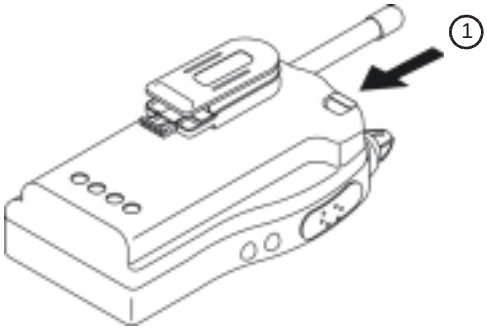


Figure 4-10 - Removal of battery

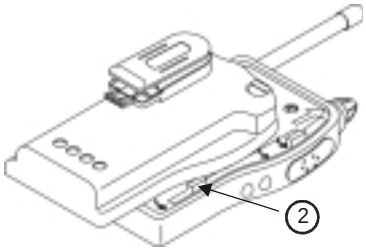


Figure 4-11 - Replacing the battery

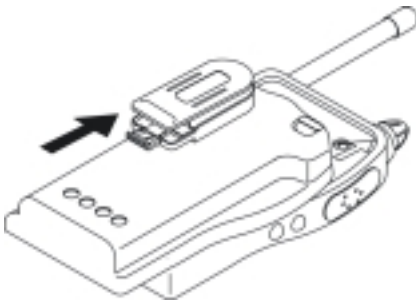


Figure 4-12 – Replacing the battery

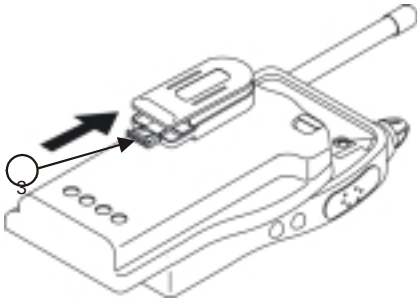


Figure 4-13 – Removing the belt clip

REMOVING AND REPLACING THE MAIN ASSEMBLY

Removal

With the battery pack removed, there are four, black, cross-head screws visible.
These can now be removed along with the black, cross head screw holding the accessories socket dust cover.

Unscrew the antenna and slide off the volume control knob.

Replace the battery **but do not** push all of the way home. Gripping the lower sides of the battery, and the lower sides of the radio lever the two apart at the bottom of the radio to separate the two.

Withdraw the module from the case.

Remove the battery from the module.

This level of disassembly will be enough for test purposes.

Note: A screwdriver, or similar object, should **never** be used to force open the radio as the sealing gasket is likely to be damaged.

To reassemble the radio, carry out the above instructions in reverse, ensuring that the seal is pushed down into the cover. Take care not to damage the sealing gasket.

With the two parts of the radio separated, for servicing, it will be necessary to link the two pcbs using the flexi-pcb ME110016, which is part of the Service Kit.

LOCATION OF ADJUSTMENT POINTS

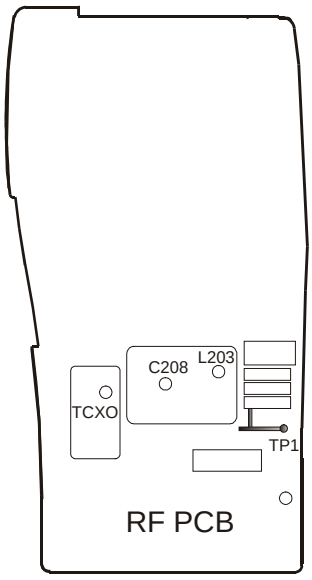


Figure 4-14 – Adjustment Points

4.5.3 PLL Alignment

Before any alignment is carried out to the transmitter, or receiver, it is necessary to align the Phase Locked Loop (PLL). The PLL consists of the Rx VCO, Tx VCO and TCXO.

If the PLL is out of lock, an audible warning will be heard UL will appear on the LCD display.

Note: This alert will also be heard when a channel is programmed out of the range of operation of the radio, or it is not programmed at all.

Note: If the power save parameter is programmed there will be a periodic change at TP1. Measurement should be based on the steady state voltage, with power save off.

In order to carry out repairs, the two halves of the radio may need to be linked using the flexi-pcb, ME110016.

This is part of the Service Kit and the Interface Box and leads will also be required for some of the tests.

Connect the radio under test to the Test Equipment.

Rx VCO

a. Select Channel 1.

b. Check that the VCO tuning voltage at TP1 is >5.7V +/- 0.25V (VHF) or >1.0V +/- 0.25V (UHF).

c. Select Channel 3

d. Check that the voltage at TP1 is <12.5V.

Tx VCO

a. Select Channel 1.

b. Set the PTT switch to on and check that the voltage at TP1 is 1.0V +/- 0.25V (VHF) or 2.0V +/- 0.25V (UHF).

c. Select Channel 3.

d. Check that the voltage at TP1 is <12.5V.

e. Set the PTT switch to off.

Note: If TP1 is below 0.6V or above 12.5V, in any of the above tests, L203 may be adjusted. L203 is covered in wax and therefore great care will need to be taken when removing the wax.

TCXO

a. Select Channel 2.

b. Set the PTT switch to on.

c. Using the frequency counter, adjust the TCXO control, so that the transmit frequency is within +/- 200Hz of the required frequency.

d. Set the PTT switch to off.

If no further alignment is to be carried out, it may be necessary to check the squelch setting.

4.5.4 Squelch Sensitivity

The RF input level to open the squelch is usually set in the range –123.5 to –117dBm (0.15 to 0.3mV). The squelch should open at a SINAD between 7 and 12dB (no CCITT).

The squelch should close between 2 and 4dB of the value at which it opens.

RV2 sets the squelch level for 12.5kHz channel spacing and RV4 sets the squelch level for 20/25kHz channel spacing.

Note: RV2 **MUST** be set before RV4.

4.5.5 Transmitter Alignment

Power Adjustment

See Section 4.4.

All further adjustments require the use of the ACC-2003 Alignment Box.

Refer to the ACC-2003 User Manual (on floppy disk) for operational information.

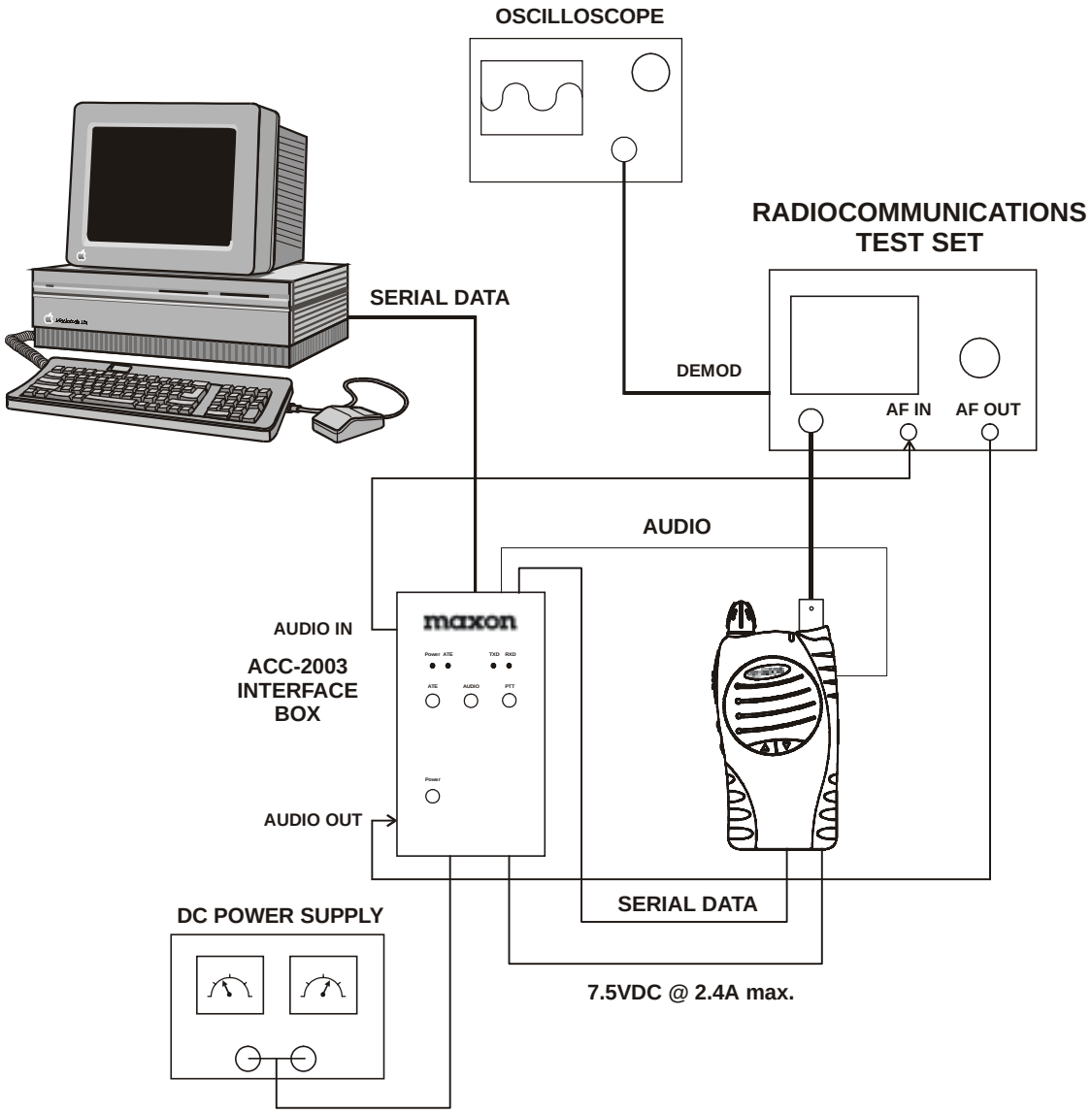


Figure 4-15 – ACC-2003 Alignment Box Test Setup

Please refer to the ACC-2003 Interface Test Jig User Guide for details on how to use the ACC-2003 Interface Box.

The radio should remain programmed as Section 4.5.1 with ASIC values being read as per the instructions.

Note: The ASIC programmer **DOES NOT** read frequency data, so only default frequencies will be displayed even though the actual radio is programmed and operational on different frequencies.

Any adjustments to deviation and balance must be carried out in accordance to the R&TTE directive.

Balance Adjustment

a. Select Channel 3 (using software).

b. Set the audio generator to a 310Hz tone, low output impedance, at a level of 400mV.

c. Press Shift + T on the keyboard to transmit.

d. Adjust TXTRIM2/TXTRIM3 to give a square wave on the oscilloscope (check that audio enable is ON on the Interface Box.

e. Press Shift + R to turn off the transmitter.

Audio deviation adjustment

a. Select Channel 3 and press Shift + T to turn on the transmitter.

b. Set the audio generator to 1kHz and adjust its level for 60% peak system deviation. Ensure that, depending upon the channel spacing of channel 3, the deviation is either:

12.5kHz channel spacing 1.5kHz dev.
or 20kHz channel spacing 2.4kHz dev.
or 25kHz channel spacing 3kHz dev.

c. Measure the audio distortion. This should be less than 5%.

d. Increase the audio level by 20dB (10x voltage).

e. Adjust TXTRIM1. to set the deviation to:

12.5kHz channel spacing 2.25kHz dev.
or 20kHz channel spacing 3.6kHz dev.
or 25kHz channel spacing 4.5kHz dev.

f. Slowly sweep the audio signal generator between 300Hz and 3kHz. Record the peak deviation. The peak deviation should be:

12.5kHz channel spacing <= 2.5kHz dev.
or 20kHz channel spacing <= 4kHz dev.
or 25kHz channel spacing <= 5kHz dev.

If necessary, adjust TXTRIM1 to keep within the system deviation.

g. Repeat para. f with the radio set to Channel 1.

If necessary, adjust TXTRIM1 to keep within the system deviation.

h. Press Shift + R to return to receive.

CTCSS / DCS deviation

a. Select Channel 4.

b. Turn off the audio signal generator so that the RF signal generator is not modulated.

c. Press Shift + T on the keyboard.

d. Adjust SATRIM2 for the desired CTCSS tone peak deviation (± 50Hz) which is:

12.5kHz channel spacing 0.25kHz dev.
or 20kHz channel spacing 0.4kHz dev.
or 25kHz channel spacing 0.5kHz dev.

e. Press Shift + R to return to receive.

f. Select Channel 5.

g. Press Shift + T and check that the deviation is the same as above. If the deviation is greater than above, adjust SATTRIM2.

h. Press Shift + R to return to receive.

i. Select Channel 4.

j. Press Shift + T to transmit.

k. Turn the audio generator back on so that the RF signal generator is modulated with a 310Hz tone.

12.5kHz channel spacing 2.5kHz dev.
or 20kHz channel spacing 4.0kHz dev.
or 25kHz channel spacing 5.0kHz dev.

l. Press Shift + R to return to receive.

Select Channel 5 and press Shift + T. Check that the peak deviation is less than:

12.5kHz channel spacing <= 2.5kHz dev.
or 20kHz channel spacing <= 4.0kHz dev.
or 25kHz channel spacing <= 5.0kHz dev.

If necessary, adjust TXTRIM to keep within the system deviation.

m. Press Shift + R to return to receive.

n. Write the changes to the radio.

This completes the transmitter alignment process.

4.5.6 Receiver Alignment

Audio Volume Level

a. Set the test set to the appropriate frequency at –47dBm with 1kHz tone modulation at 60% system deviation:

12.5kHz channel spacing 1.5kHz dev.
or 20kHz channel spacing 2.4kHz dev.
or 25kHz channel spacing 3kHz dev.

b. Select Channel 1.

c. With the calibration program running on the PC, select Rx_Vol.

d. Turn the volume control to maximum.

e. Using the PageUp and PageDown keys, press until the desired maximum volume level is achieved.

Note: -17.5dB corresponds to 2.10V (+/-0.2V) into 4 ohm speaker.
At maximum volume, nominal distortion is 10%.

f. Write the changes to the radio.

It may be necessary to carry out adjustment of the squelch setting, see Section 4.5.4.

This completes the receiver alignment process.

The following parameters would NOT normally be adjusted unless specific environmental conditions necessitate a change:

INTRIM on the receiver (Audio from IF IC.)

SATRIM on the receiver (gain received – sub audible tone)

Refer to the ACC-2003 User Guide for details.

5 DETAILED FUNCTIONAL DESCRIPTION

5.1 Introduction

This section provides a detailed description of the operation of the radio.

5.2 Common Circuits

Power Circuits

Battery voltage, or external voltage through the accessories connector, is applied via a 4A fuse (plus diode protection) directly to the RF power module and, after the on/off switch, to the dc to dc converter and voltage regulator. The majority of the circuitry is powered via IC1, which regulates the +7.5V dc supply down to +5V.

Transistors Q2 and Q32, in conjunction with the Tx Enable and Rx Enable lines from the microcontroller, apply +5V Tx or +5V Rx to the relevant circuitry during receive or transmit. Thus, for instance, the receive front end amplifier is only powered during receive and the power control IC is only powered during transmit.

It is possible to program the radio for power saving. This mode causes the microcontroller to pulse the Rx Enable line high and low for periods between 100 and 300mS. The time may be selected when programming the radio. As soon as the radio detects a signal it switches into normal mode.

Microcontroller

The microcontroller (IC403) is a One Time Programmed Processor chip based on the Hitachi HD3837 processor with onboard ROM and RAM.

It controls all functions performed by the radio, in conjunction with control signals from push buttons, switches etc. It controls the data to/from the EEPROM and to the PLL IC, Audio ASIC as well as controlling external data from the programmer and alignment interface. The microcontroller generates the enable lines, controlling routing of signals and the indicators (LED,LCD and bleeps).

The microcontroller also generates and decodes the SAT tones (filtered by the ASIC).

EEPROM

Relevant channel information, such as Rx / Tx frequencies and CTCSS / DCS codes, is stored in the EEPROM (IC404) which is a X25330. This information may be programmed and erased via the accessories socket. Certain parameters can also be altered via the pushbuttons and keys on the radio, i.e. scan channels and priority channel. The EEPROM has 32768 (8x4096) capacity and data is written serially.

Channel Select Circuit

Up to 199 channels may be selected, using the channel keys on the front panel. Pressing the channel keys earths pins 40 and 41 of the microcontroller, so enabling the decoding for the appropriate Rx and Tx frequencies, and associated data, to be selected from the EEPROM.

5.3 Audio ASIC

The audio ASIC (IC406) processes both the audio signal and the sub-audible tones, including filtering, amplifying, setting attenuations levels etc. It is a programmable device, controlled by the microcontroller, hence alteration of deviation levels is achieved by the ACC-2003 Alignment Software.

The internal block diagram is shown in Figure 5-1. The audio and SAT routes within the ASIC will be described separately.

5.3.1 Audio Signal Path

A1	Buffers discriminator audio input from Pin 30 (INI) and passes it to Analogue Switch 1 (ASW1). It has a gain of x1.
A2	Amplifies the analogue signal from the mic input terminal (IN2) and passes this signal to Analogue Switch 1. It has a gain of 10dB.
ASW1	This is a two-way analogue switch. It is controlled by the serial control interface. Default value is 0, which is Rx (A1).
INTRIM	Sets the deviation for the input analogue signal sensitivity. The control range of this device is –3.5 to +4dB controllable in 16 steps. The control is a 4 bit signal where the default value is 1000, which corresponds to 0dB.
300Hz HPF	Comprises an 8^{th} order filter with a cut-off frequency of 300Hz. Attenuation of the unwanted is at least 30dB.
ASW2	This is a four-way analogue switch, controlled by the serial control interface. It passes the received audio to the de-emphasis circuit or the transmit audio to the pre-emphasis circuit. Alternatively, the pre-emphasis or de-emphasis can be bypassed. The control signal is a 2 bit signal with 00 as the default, which is de-emphasis.
DE-EMPHASIS	Applies de-emphasis to the received audio at 6dB/octave. At 1kHz, the gain is x1.
PRE-EMPHASIS	Applies pre-emphasis to the transmit audio at 6dB/octave. At 1kHz, the gain is x1.
RXVOL	Controls the magnitude of the Rx audio signal which is passed, via the volume control (VR5) to the speaker in 16 steps from 0dB attenuation up to 37.5dB attenuation, to Rxout on pin 28.
AMP	This amplifier provides gain, to the Tx audio, in 8 steps from +20dB to +41dB.
LIMITER	Applies limiting at 0dB (2.8V p-p). The output of this stage is controlled in 4 steps from 0dB to –5.4dB attenuation by a 2 bit control signal.
ASW3	This is a two-way analogue switch, controlled by the serial control interface. It passes the Tx audio, or the SAT to the low-pass filter.
VLPF	This is a 6^{th} order low pass filter, which is controlled by the serial control interface. The cut-off point is switched between 2.55kHz and 3kHz.
TXTRIM1	Provides deviation adjustment of Tx audio in 16 steps from +3.5dB gain to –4dB attenuation. Uses a 4 bit control signal.
TXSUM	Mixes (Adds) the signal from TXTRIM1 with the SAT signals from COMPIN+, or selects one or other of the signals. Can also apply 50dB muting. Controlled by the serial control interface.
ATTN	Attenuates the signal from TXSUM by either 0dB or 6dB.
TXTRIM2/3	Signal follows two routes (to VCO & TCXO) for final deviation adjustment in 32 stages from +3.75dB to –4dB. Controlled by 5 bit signal.
A3/A4/INV	Final output buffer amplifier for Tx analogue signal. Gain is 0dB. A3 output (modout 1 on pin 1) goes to the VCO and A4 (modout 2 on pin 2) goes to TCXO, are non-inverting outputs. The inverting output (INV) from A4 is not used.

5.3.2 Sat Signal Path

ASW4	ASW4 switches between RxSAT (RDIN) and Tx SAT (TXIN) and routes to the filter.
VSCLPF	Seventh order Elliptic Variable Switched Capacitor Low Pass Filter. Cut-off frequency is variable from 50Hz to 300Hz. Level adjustable in 0.5dB steps from –3dB to +2.5dB. Output is on pin 23 FLT OUT.
SATRIM1	Not used.
SATRIM2	SAT level adjustment. Amplitude is controlled in 0.5dB steps from –3dB to +2.5dB. Output is on pin 23 FLTOUT.
COM	Compares the external reference voltage (COMPPIN-) with the applied SAT signal which is from FLTOUT to COMPIN+ and it goes to Logic High and Logic Low at this point. The output COMPOUT (pin 21) goes to the microcontroller IC406. NB in transmit the SAT is switched into TXSUM.

5.3.3 Miscellaneous Signals and Controller

ADC / DAC	ADC is not used. DACs are 8 bit devices.
CONTROL	Control serial interface for control lines.
DATA	Operates as output line for a READ instruction and as input line for a WRITE instruction, Pin 18.
CLOCK	This is the synchronous input terminal for communication with the microcontroller, pin 12.
ENBL	With an active low, data read and write is enabled.
AGND.DGND	Reference analogue and digital grounds.

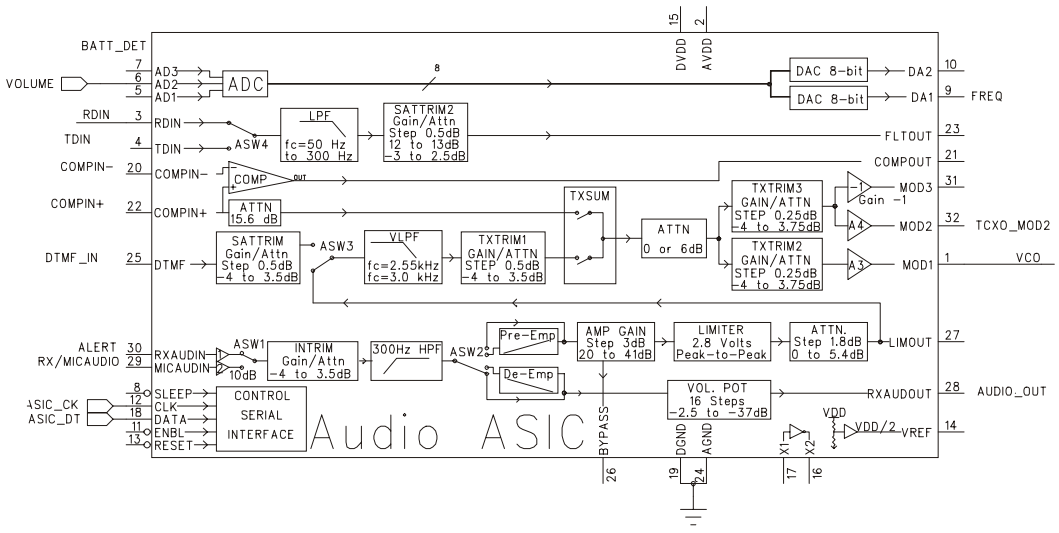


Figure 5-1 – ASIC Block Diagram

5.4 Audio/SAT Circuits

CTCSS / DCS Decoder Circuits

Discriminator audio from pin 9 IC5 is applied, via IC408D, to pin 3 of the audio ASIC. The audio frequencies of the signal are filterecd out by the 7th order Elliptic Low Pass Filter, leaving only the SAT audio tones. The level is then set by the ASIC and is routed via IC407A back to the ASIC for comparison with a reference voltage. This produces the logic data signal. This logic signal on pin 21 (IC406) is fed into the microcontroller (IC403) where it is matched with a programmed frequency. If there is a successful match, decode occurs, which is shown by a green LED on the top of the radio and audio is heard. If there is an invalid decode, the LED will light yellow (BUSY)

CTCSS / DCS Encoder Circuits

During TX encode the tone squelch digital signal is produced as a 3-bit parallel word at pins 48, 49 and 50 of the micro controller (IC403). The 3-bit digital signal is converted to an analogue signal by resistors R420, 421 and 423. The analogue signal is fed into IC406 pin 4 where it is filtered and its deviation level is set.

The filtered encode output from pin 23 (IC406) is fed back into pin 22 (IC406) via IC407a (LM358). The filtered encode signal is mixed with the audio signal from TXTRIM1 by TXSUM. Via ATTN, the mixed signals are applied to TXTRIM2/TXTRIM3, which controls the modulation to the VCO and TCXO respectively (see RF description).

External Mic / PTT Control Circuit

The external microphone is connected via a 3.5 mm stereo jack socket on the right-hand side of the radio. The internal mic and speaker are disabled when the external connector is plugged the SPK/MIC jack socket.

When the external PTT is depressed, a low impedance is presented to the base of Q403 (below 20k ohm). Q402 and Q403 switch on and so Q402 collector is low (normally tied high). This point is connected to IC403 (microcontroller) pin 43 (PTT). The same point is connected to the normal PTT button, SW403, which is earthed when depressed.
The mic audio itself is switched through IC401A by the Tx enable line to IC408D amplifier stage and through to the audio ASIC for filtering and deviation level setting. As described previously, this audio signal is added to the SAT and routed to the TCXO and VCO.

Rx Audio

The discriminator audio is fed directly into the audio ASIC from the RF section (see later). The ASIC sets the gain and filters out any SAT. The output is fed to the volume control (VR5). The alert tones and switch on melody is routed from the microcontroller via link LK27 to the same point to the volume control.

The AF from the volume control is fed to the audio amplifier, a TDA7233, which is activated by the mute circuit. The output is then fed to the internal or external speaker.

Mute Circuit

The microcontroller (IC403) has a mute circuit which is output on pin 13 (7233EN). The operation of the mute depends upon a number of factors, such as is the demodulator receiving a mute signal from the FM detector and does the signal have the correct CTCSS / DCS. The microcontroller will also change the state of the mute if the monitor button is depressed (SW402), assuming that this function has been enabled in the programming

Pin 13 is connected to Q414, Q415 via R446, which mutes the TDA7233IC.

Battery Low Indicator Circuit

When the battery voltage drops below 5.6 VDC a Battery Low indication is given. Due to the volts drop across D403, a voltage below 5.6V on the battery gives a voltage less than 5V on the base of Q405. , Q405 switches on its when base is below 5v (current flow through R413), which switches on Q404, so driving pin 52 of the microcontroller low (normally tied high). The micro controller disables the transmitter and at the same time enables the red LED and sends an alert tone to warn the user. The battery should be replaced or recharged at this time (one transmission is allowed after the low battery warning).

LEDs and indicators

The red and green LEDs are switched on, via Q407and Q411, by control lines from the microcontroller. Both the red and green LEDs being lit indicate the condition 'busy' i.e. orange. Both the LCD and backlight are driven from the microcontroller.

The alert tones are generated in the microcontroller and are fed through a filter to the volume control via link 27. There is an option of routing the tones directly to the audio amp via link28.

5.5 Common RF Circuits

PLL Synthesiser

The PLL synthesiser circuit is common to both the transmitter and receiver.

The synthesiser comprises:

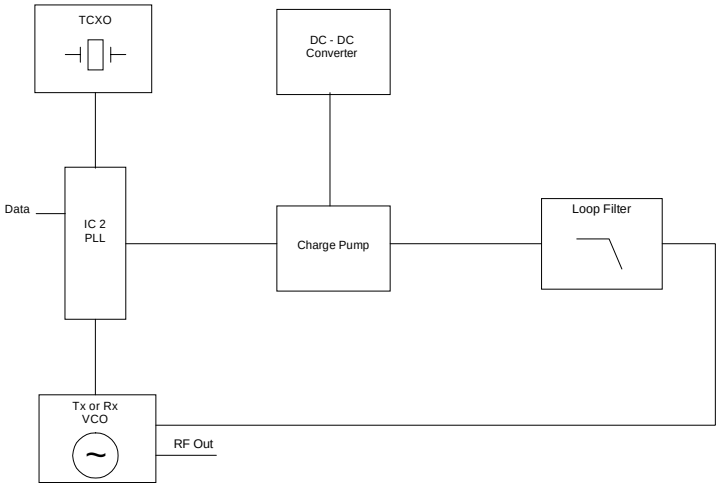


Figure 5-2 – Synthesiser Block Diagram

12.8 MHz TCXO

The TCXO contains a crystal oscillator, which has 2-stage thermistor network compensation, and a modulation port. Accuracy is +/-2.5 PPM from -30°C to +60°C. Frequency adjustment is provided by TC701.

VCO

The VCO is configured as a Colpitts oscillator using transistor Q202, varactor diodes D201 / 202, frequency setting inductor L203 and associated components. Cascade bias is provided by Q201.

The frequency of operation is controlled by reverse biasing D201 in the range of 1 to 12 V dc (from the PLL). During receive Q9 is switched on by the Rx enable (active low), so switching D203 in circuit (via Q203), which puts C208 (variable capacitor) in parallel with the varactor diodes and adjustable inductor.

In transmit the VCO has modulation from the audio processing circuitry applied to D202. C204 is used to provide compensation for non-linearity caused by the modulation diode and maintains a constant modulation regardless of the frequency of operation.

PLL IC

The reference frequency from the TCXO, at 12.8 MHz, is connected to pin 20 of IC2 (MC145191). The appropriate VCO is connected to pin 11.
The external reference frequency, TCXO input, is divided by the reference divider (REFDIV), which is set to divide by 2048 for 12.5kHz or 25kHz channels (6.25kHz) or to divide by 2560 for 20kHz channels (5kHz). This is known as the reference frequency, Fr.

The comparison frequency is determined by the settings which are stored within the EEPROM (IC404). Choice of these comparison frequencies means that the minimum step size of the synthesiser is either 5kHz or 6.25kHz and therefore, 12.5kHz, 20kHz and 25kHz channel spacings can be accommodated.

IC2 is programmed on pin 19, to obtain the desired frequency, by serial data from the microcontroller (IC403 pin 21). IC2 Pin 19 is the data input and pin 18 is the clock input and pin 17 is the PLL enable line.

The VCO frequency, Fin, is divided down by the programmable divider (64/65 prescaler VARDIV) to, again, produce 5kHz or 6.25kHz. This frequency is known as the variable frequency, Fv.

In the phase/frequency comparator, the phase difference between the reference frequency, Fr, and the VCO signal, Fv, is compared.

When Fv = Fr, the phase detector output (pins 3 and 4, IC2) produces narrow negative pulses and Fv and Fr pulse widths are identical. When Fv > Fr, pin 4 (V) pulses negative, with pin 3 (R) remaining high. When Fv < Fr, pin 3 (R) pulses negative with pin 4 (V) remaining high. The signal at pins 3 and 4 is smoothed by the loop filter and applied to the VCO.

Out-of-Lock Detector

The out-of-lock detector output remains essentially high with narrow low-going pulses when in lock. The output pulses low when Fr and Fv are out of phase or at a different frequency (results in wider pulses). These pulses at pin 2 are buffered by Q5 and then integrated by R1 and C11. The resultant voltage is fed to the microcontroller, IC403, pin 53.

IC2 has two output ports:

Port A pin 16	Configurable digital port, which is used as tx enable 2, which controls the application of volts to the PA stage.
Port B pin 15	Open drain digital output, which is used as a power save control.

Pin 13 labelled test2 allows the technician to see the output of the dual modules prescaler for trouble shooting purposes, no connection should be made to this pin.

Charge Pump and Loop Filter

Transistors Q6 to Q8 and Q11, and associated components, form the charge pump. The phase detector output from IC2 pins 3 and 4 are combined by the charge pump to produce a 0 to 12V tuning voltage.

The voltage signal is filtered by the loop filter (R12 – R14, C21 - C24) to remove harmonics of the reference frequency.

DC to DC Converter

The DC to DC converter, converts the +7.5 V to a 16 V suppy. This is used to provide the tuning voltage for the VCO. A wide voltage range is required to allow for the wideband operation of the radio.

Q904, Q905 and associated components, form a 200kHz oscillator. The output of the oscillator is rectified (voltage tripled) by D901, D902 and D903. C901, C902 and C916 provide filtering. The resultant 16Vdc is passed to R909 and then becomes the supply rail for the charge pump.

5.6 Transmitter

The transmitter comprises:

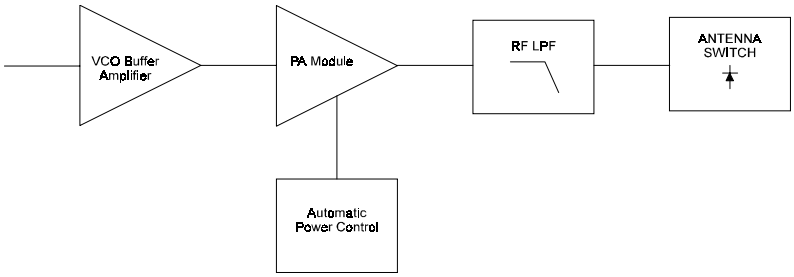


Figure 5-3 - Transmitter Block Diagram

Buffer

The RF output level from the VCO is 0dBm. This is amplified to +17dBm by the buffer amplifier consisting of Q16, Q17, Q3 and associated components. All stages are simple common-emitter amplifiers with resistive biasing and tuned collectors. A pi-type attenuator (R31, 32 and 34) is used between the two stages.

PA module

The PA module consists of a hybrid amplifier. Pin 3 is permanently connected to the battery voltage and pin 2 is connected to the supply when switched by Q22, which is controlled via the power control circit by the Tx enable line. The RF input is on pin 1 and the output is on pin 4.

Low pass filter

L7, L8, L11, C73, C74, C75 and C76 form a 7th order Chebyshev low pass filter. Unwanted harmonics are reduced by 65dB.

Antenna Switch

When transmitting, the diodes D5 and D6 are forward biased, allowing the RF to pass to the antenna. D6 is shorted to ground which makes L13 look open circuit (1/4 wave tuned stub). This prevents the Tx signal from passing to the receiver stage.

In receive, the diodes D5 and D6 are reverse biased. L13 is now in circuit, passing the signal from the antenna to the front end without signal loss.

Automatic power control (APC) circuits

The APC circuit consists of IC3B, Q19, Q21, Q22 and associated components. The PA supply current passes through R109. Variations in power output, produce variations in supply current, which is amplified by IC3A and Q19.

The voltage on the wiper of RV1 is passed to IC3B and compared with the fixed reference voltage developed by the potential divider R45 and R46. The output of IC3B, pin 7, controls Q21 and Q22 to provide supply voltage to the PA driver transistors Q501 and Q502. RV3 controls the low power setting and is switched into circuit by Q23.

A change in PA output will result in an inverse change in driver supply voltage maintaining a constant RF output.

5.7 Receiver

The receiver comprises:

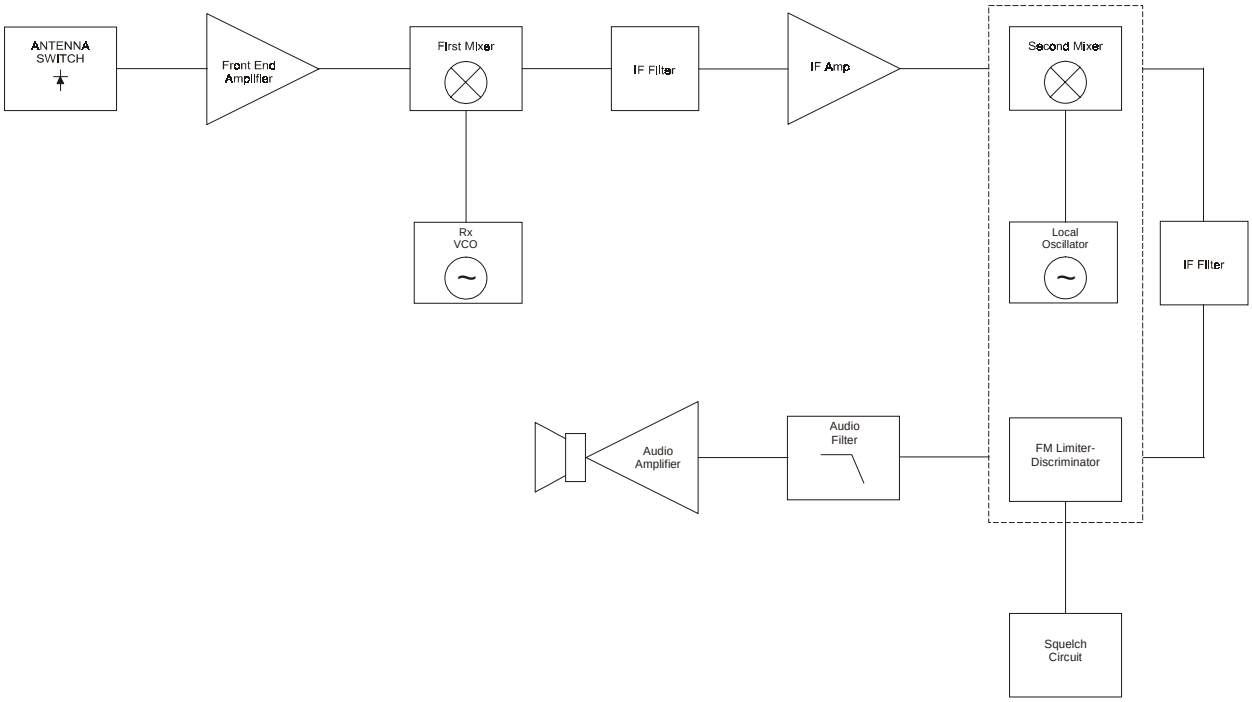


Figure 5-4 - Receiver Block Diagram

Antenna Switch

In receive, the diodes D5 and D6 are reverse biased. L13 is now in circuit, passing the signal from the antenna to the front end without signal loss.

Front End

The receive signal is routed to the RF Front End module, pin 1. It passes through a matching circuit consisting of C601 to C603 / L601 & L602.

Diode D601 serves as protection from RF overload from nearby transmitters.

The input signal is coupled to the base of Q601 which serves as an RF amplifier. The output of Q601 is then coupled to a bandpass filter consisting of C604 to C620 / L603 to L607.

The output of the front end module, pin 6, is then coupled to the double-balanced mixer D9.

The receiver front end module is factory pre-tuned and requires no adjustment. Repair is effected by replacement of the entire module.

The modules are:

VHF 146 MHz to 174 MHz
UHF 440 MHz to 470 MHz.

First Mixer

D9, T1 and T2 form a double balanced mixer which provides the 45.1MHz intermediate frequency output. The filtered frequency from the front end module is coupled to T1.

The Local oscillator input from the VCO is coupled to T2.
The output of the mixer is taken from the tap on transformer T1 and fed to the single pole diplexer, comprising L15 / C93 and R65 (High-pass terminating filter) and L14 / C92 (Low-pass coupling filter)

The 45.1MHz crystal filter provides a bandwidth of +/-7.2 kHz. This filter provides a high degree of protection from spurious and intermodulation products. Additionally, a 90 MHz trap (C93 / L15) is placed at the filter input.

The output of the filter is coupled by C43 to the base of the post filter IF amplifier Q25.

Second mixer, Second IF, FM detector

The output of the IF amplifier is fed into the narrowband FM IF Integrated Circuit, IC5 (MC3372). This is a single conversion FM receiver which contains the second mixer, second IF amplifier, and FM detector.

The second local oscillator frequency is determined by the crystal X1 connected to pin 1 of IC5. In this case the crystal has a frequency of 44.645MHz. The first IF signal is applied to the mixer and the resultant frequency of 455KHz, is the difference between the IF signal and second local oscillator.

The 455KHz IF signal is output from pin 3 and is applied to a 455KHz band-pass filter, CF1 (20/25 kHz channel spacing) or CF2 (12.5 kHz channel spacing). The selection of the filters is accomplished by diodes D13 (input) and D14 (output) whose bias is controlled by the N/S SW line on the microcontroller (IC403, pin 25).

The microcontroller takes the relevant channel spacing data from the EEPROM. A High on the N/S SW line switches the 455kHz signal to CF1, a low switches the signal to CF2.

The output of the relevant IF filter is passed to pin 5, which is the input to the limiting amplifier.

The limiting amplifier is biased externally by R19 & R95 and connected by C52 to the quadrature detector (X2). The output connects to pin 8. The quadrature circuitry provides a 90° phase shift at the IF centre frequency, which enables audio to be recovered. Any detected signal is produced at pin 9 of IC5 and applied to the Receiver Audio Circuit and the Mute (Squelch) Circuit.

Squelch (Mute) Circuit

The mute circuit switches off the audio amplifier when no audio signal is present. The squelch circuit consists of IC5 and RV2 (RV4) and their associated components. The noise signal from pin 9 of IC5 is amplified by an internal amplifier in IC5 and fed to the 16kHz bandpass filter.

16kHz Band Pass Filter

The audio signal from pin 9 of IC5 is filtered by a 16 kHz band pass filter consisting of L16, L17 / C111 to C113. The noise in the IF passband is accepted and voice frequencies and their products are rejected.

Any noise present at the output of the filter is applied to the noise detector circuit via RV2 (RV4). RV2 (RV4) is used to adjust the squelch circuit sensitivity and is normally adjusted to produce a noise squelch opening sensitivity of 10 to 12 dB SINAD.

For 12.5 kHz channel spacing, RV4 is switched in, by the microcontroller and Q28, to attenuate signal at RV2 for 25 kHz channels. A High on the N/S SW line switches in RV4.

The output from the band pass filter is applied to the filter amplifier input on pin 10 of IC5.

Noise detector circuit

The noise detector circuit, in conjunction with IC5, consists of transistors Q26, Q27, thermistor TH1 and diode D11. Any noise signal present is applied to Q27 from pin 11 of IC5. The signal is amplified by Q27, rectified by D11 and then buffered by Q26. The buffered signal is applied to pin 12 of IC5 (Squelch input).

The squelch trigger output (pin 14, IC5) is applied to the microcontroller BUSY input on pin 54 of IC403. The actual audio mute is from the microcontroller.

When noise is present, the voltage at pin 12 of IC5 (Squelch input) exceeds 0.7V. This causes the squelch trigger output to go open circuit, which turns on Q24 and the busy line goes low, which mutes the receiver audio circuit.

When no noise is present, the voltage at pin 12 of IC5 is less than 0.7 V and pin 14 of IC5 is grounded, which switches Q24 off, so the busy line goes high, unmuting the receiver audio circuit. Resistor R74 is used to provide hysteresis of 3 to 6 dB.

AF Output Low Pass Filter

A low pass filter formed by C115, C116 and R91 removes any extraneous 455 kHz energy from the AF output of the FM receiver chip.

Speaker Audio Amplifier

After signal detection and audio filtering the signal is passed to the digital board, to the audio ASIC (via IC408 for SAT).). After the audio ASIC (see previous description) the signal is then routed, via the volume control (VR5), to pin 8 of IC402. IC402 is a TDA7233 audio amplifier, which is enabled by the control line from the microcontroller via Q415 and Q414.

6 TROUBLESHOOTING

This section includes voltage and troubleshooting charts which should assist the engineer to isolate and repair the fault. Voltage measurements should be made using a high-impedance voltmeter and the values given are with respect to ground.

Obvious checks, such as battery performance on load, should be made before pulling the radio apart. Substitution of another set of batteries, or the use of a power supply, isolates this cause.

The alignment procedures, given in Section 5, list how standard tests such as SINAD measurements can be made. These can be used to check the performance of the receiver.

Careful alignment, using suitable test equipment, and quality interface cables should ensure that the radios meet their specified performance.

6.1 Diagnostic Function

The diagnostic function is designed to inform the user about the operational status of the radio. The possible audible and visual warnings are:

Status	Description	LED Colour	LCD Indication	Audible Tone
Normal	Power On Ready	N/A	188	Melody
	Busy	Yellow	Channel Number	N/A
	Correct S.A. Tone	Green		N/A
	Transmit	Red		N/A
	Transmit Not Allowed	Red Flashing	Alternating UL with Channel No.	Repeating Dual Tone
Scanning	Scan	Flashing Green		N/A
	Priority Scan Mode	Green Flashing	N/A	N/A
	Priority Lookback	Green Flashing	Lb/Channel Number	N/A
Priority Edit	Edit Priority Channel	Two Red Flashes	PE	N/A
Scan Edit	Edit Scan List	Single Red Flash	SE	N/A
Warning	Time-Out Timer	N/A	Pt	Single Tone/Triple Tone Repeated
	Busy Lock	Flashing Yellow	bL	Repeating Single Tone
	Tx Inhibit	N/A	_h/r0	Two Beeps
	Battery Low	Flashing Red	LC	Repeating Triple Tone
Error	EEprom	N/A	Er	Repeating Single Tone
	PLL Error	N/A	UL	Repeating Dual Tone

Table 6-1 – Diagnostics

Note: All audible tones can be programmed OFF for silent operation.

6.2 Troubleshooting Chart

Symptoms	Causes	Remedy
Radio does not work	1. Battery is discharged (below 6V =/-10%) 2. Fuse blown 3. 5V supply missing	1. Replace battery 2. Replace Fuse 3. Check IC5 (5V +/-0.2V)
Warning Tone and radio does not work	1. PLL error 2. EEPROM failure 3. Low battery	1. Check TCXO/VCO/PLL IC freqs programmed 2. Re-program 3. Replace, or charge, battery
Poor Rx sensitivity (-10 to –60dBm)	1. Defective Antenna switch 2. Defective front-end 3. Defective mixer 4. IF IC 5. VCO output level 6. LO frequency	1. Check D5 & D6 2. Check front end 3. Check D9, T1 & T2 4. Check X1, CF1/CF2 & IC5 5. Check Rx VCO level >+1.2dBm 6. Retune TCXO
Defective Rx	1. VCO frequency change or drop in level 2. Defective voltage source	1. Repair VCO Defective IF IC (IC1) 2. Check IC1
PLL Error	1. Defective 12.8MHz TCXO 2. Voltage source for Rx VCO / Tx VCO 3. Defective PLL	1. Replace TCXO 2. Check Rx VCO / Tx VCO 3. Replace IC2. Check DC/DC converter
Low / No Tx power	1. Tx Amp	1. Check Q9, IC9 & power control loop
No modulation	1. Audio ASIC	1. Check IC406
No programming		1. Defective programming lead 2. Check accessories connector.

Table 6-2 – Troubleshooting chart

6.3 Voltage Charts

The following voltages have been measured on a VHF radio. The Control Circuit, Main Circuit and Integrated Circuit voltages apply to the UHF radio as well.

6.3.1 Transistors (Main Circuit)

		Rx			Tx	
Ref. No.	B	C	E	B	C	E
Q5	0	0	0	0	2.0	0
Q6	4.0	0.7	1.5	4.0	1.0	1.5
Q7	5	0	0	4.5	0.7	0
Q10	0.5	0	0	0	0	0
Q11	3.0	4.0	0	4.5	4.5	4.5
Q12	5	0	0	0	0	3.3
Q13	14	14	14	3.0	15	15
Q14	0.5	0	0	3.0	0	0
Q15	4.0	4.0	0	4.0	0.7	4.0
Q16	0	3.0	4.0	0	4.0	4.0
Q17	3.0	0	0	3.0	0	0
Q18	0	4.0	4.0	0	4	4
Q19	4.0	0	4.5	4.5	0	4.5
Q20	0	4	4	4.0	0.7	4.0
Q21	4.0	4.0	0	0	4	4
Q22	4.5	0	0	0	0.4	0
Q23	4.0	0.7	4.5	4.0	0.7	4.5
Q24	0	4.5	5	0	4.5	5
Q25	4.5	0.7	4.5	4.5	0.7	4.5
Q26	0	0.7	0	3.0	0	4.0
Q30	4.0	0	0	4.0	0	0

Table 6-3 - Main Circuit Transistor Voltages

6.3.2 Integrated Circuits

				Receive					
Pin	IC1	IC3	IC4	IC5	IC6	IC9	IC11	IC12	IC18
1	3.5	1.8	1.9	GND	1.2	1.6M	1	0	AUDIO
2	3	AUDIO	0	GND	1.4	4.5	GND	0	AUDIO
3	3.5	4	1.9	GND	1.6	4.5	0	0	AUDIO
4	3.6	AUDIO	1.9	4.5	1.5	4.5	GND	0	4.5
5	3.3	AUDIO	1.9	GND	0	4.5	AUDIO	GND	AUDIO
6	3.3	GND	5	6	0	0	6	4.5	AUDIO
7	3.3	GND	1.9		0	0	3	4.5	AUDIO
8	3.7	GND	A		0	0	1	4.5	AUDIO
9	0	0.5	CLK		4	4.5			AUDIO
10	0.8	0.5	0		0	2			AUDIO
11	1	4.5	5		2.5	2			4.5
12	0	0	0		4.5	4.5			AUDIO
13	3.5	2.5	1.9		0	3			AUDIO
14	0	2.5	1.9		4	4.5			AUDIO
15	0	AUDIO				0			
16	1.8	4.5				0			
17						4.5			
18						0			
19						0			
20						2			

Table 6-4 - Integrated Circuit Voltages (Receive)

				Transmit					
Pin	IC1	IC3	IC4	IC5	IC6	IC9	IC11	IC12	IC18
1	-	0	1.9	GND	1.8	1.6M	1	0	AUDIO
2	-	0	0	GND	1.6	4.5	GND	0	AUDIO
3	-	0	1.9	GND	1.7	4.5	0	0	AUDIO
4	-	0	1.9	4.5	1.5	4.5	GND	0	4.5
5	-	0	1.9	GND	0	4.5	1.2	GND	AUDIO
6	-	GND	5	6	0	0	6	4.5	AUDIO
7	-	GND	1.9		0	0	6	4.5	AUDIO
8	-	GND	A		0	0	1	4.5	AUDIO
9	-	4.5	CLK		0	4.5			AUDIO
10	-	4.5	0		0	2			AUDIO
11	-	0	5		0	2			4.5
12	-	1.9	0		0	4.5			AUDIO
13	-	1.9	1.9		1.0	3			AUDIO
14	-	1.9	1.9		0	0			AUDIO
15	-	1.9			0	0			
16	-	4.5			4.5	4.5			
17	-					4.5			
18	-					0			
19	-					0			
20	-					2			

Table 6-5 - Integrated Circuit Voltages (Transmit)

COMPONENT LOCATION – Top Side of Digital pcb

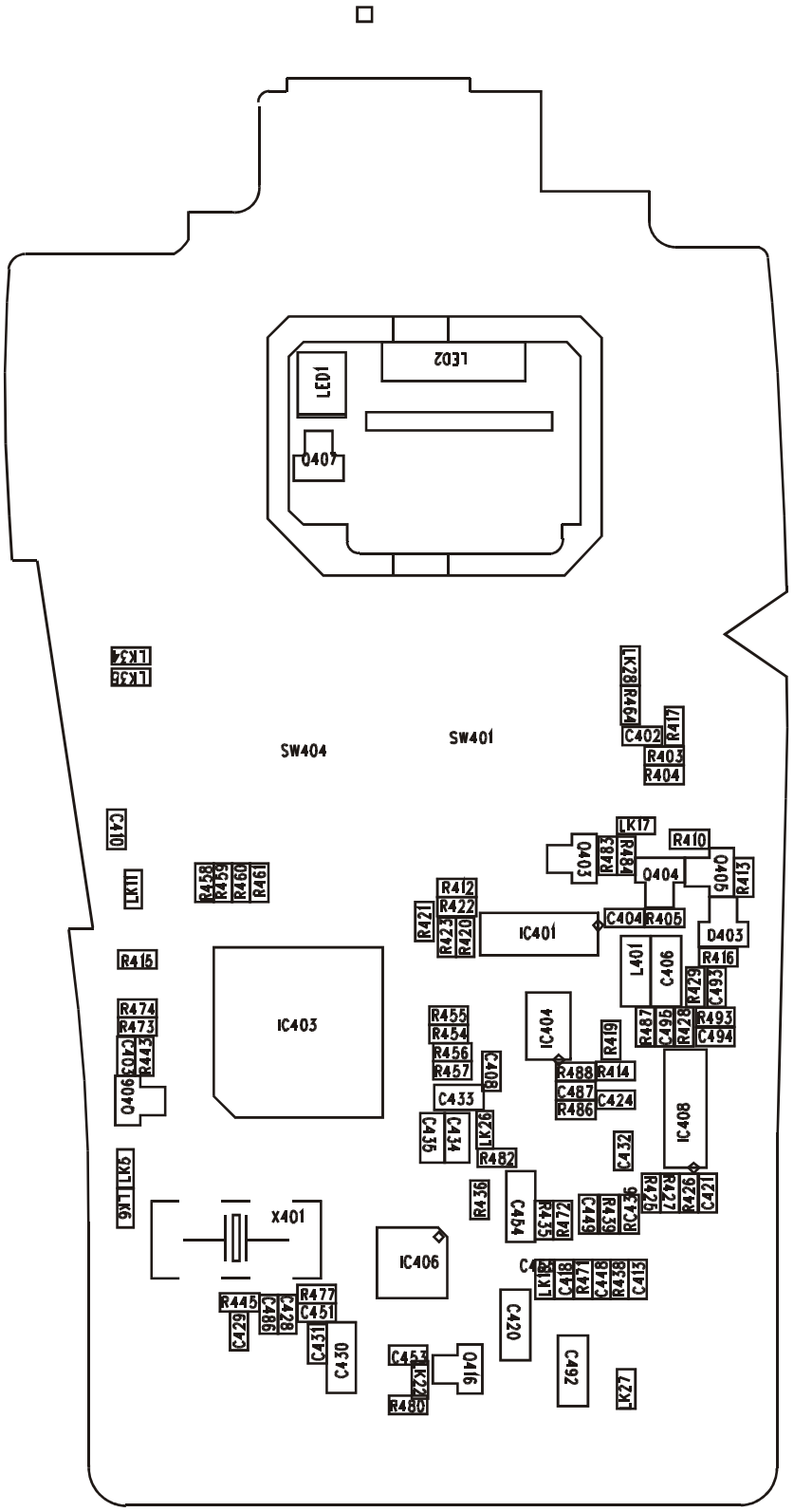


Figure 6-1 – Legend Layout for Top Side of Digital PCB

COMPONENT LOCATION - Bottom side of Digital pcb

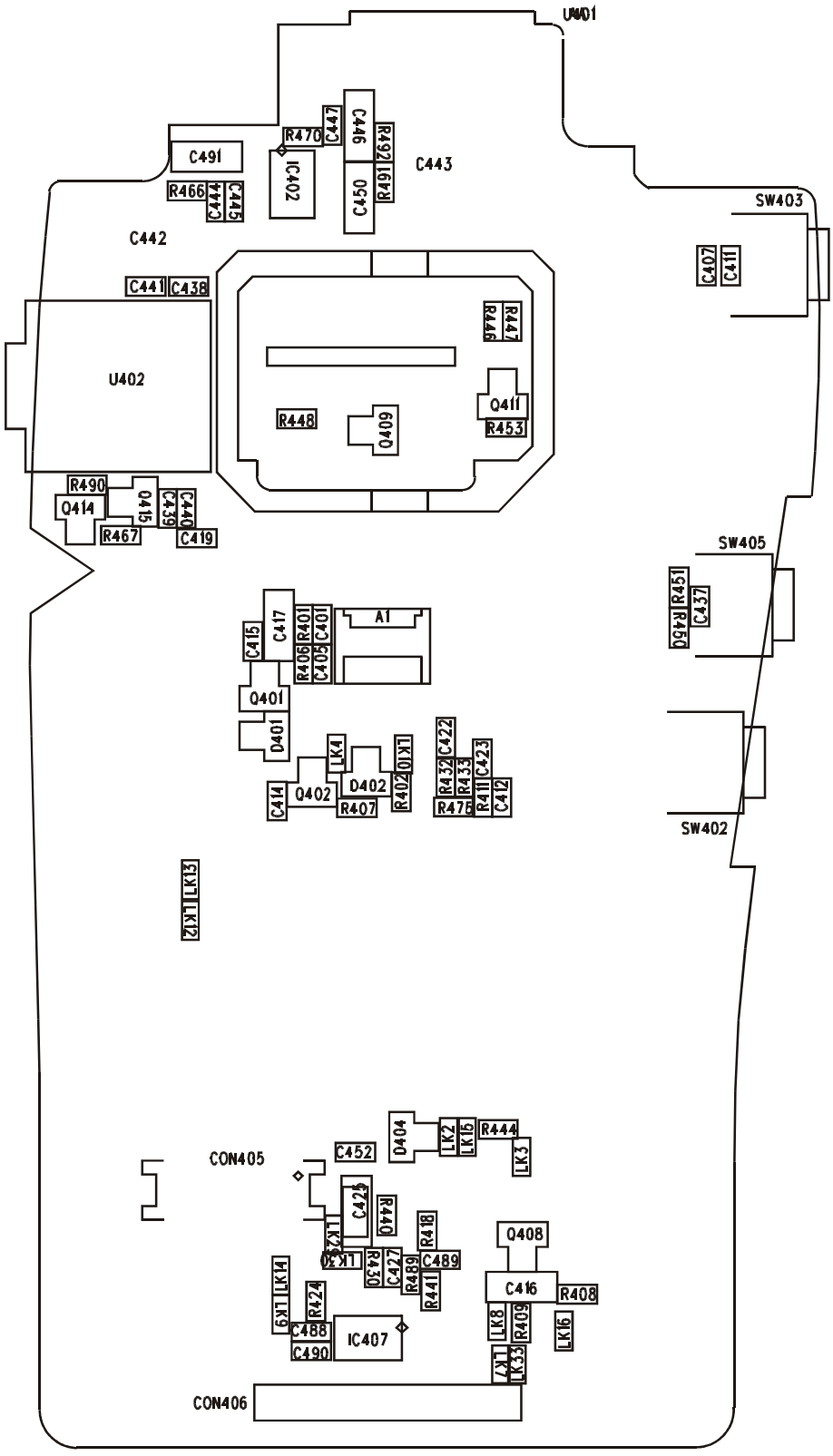


Figure 6-2 - Legend Layout for Bottom Side of Digital PCB

COMPONENT LOCATION – Top side of RF pcb

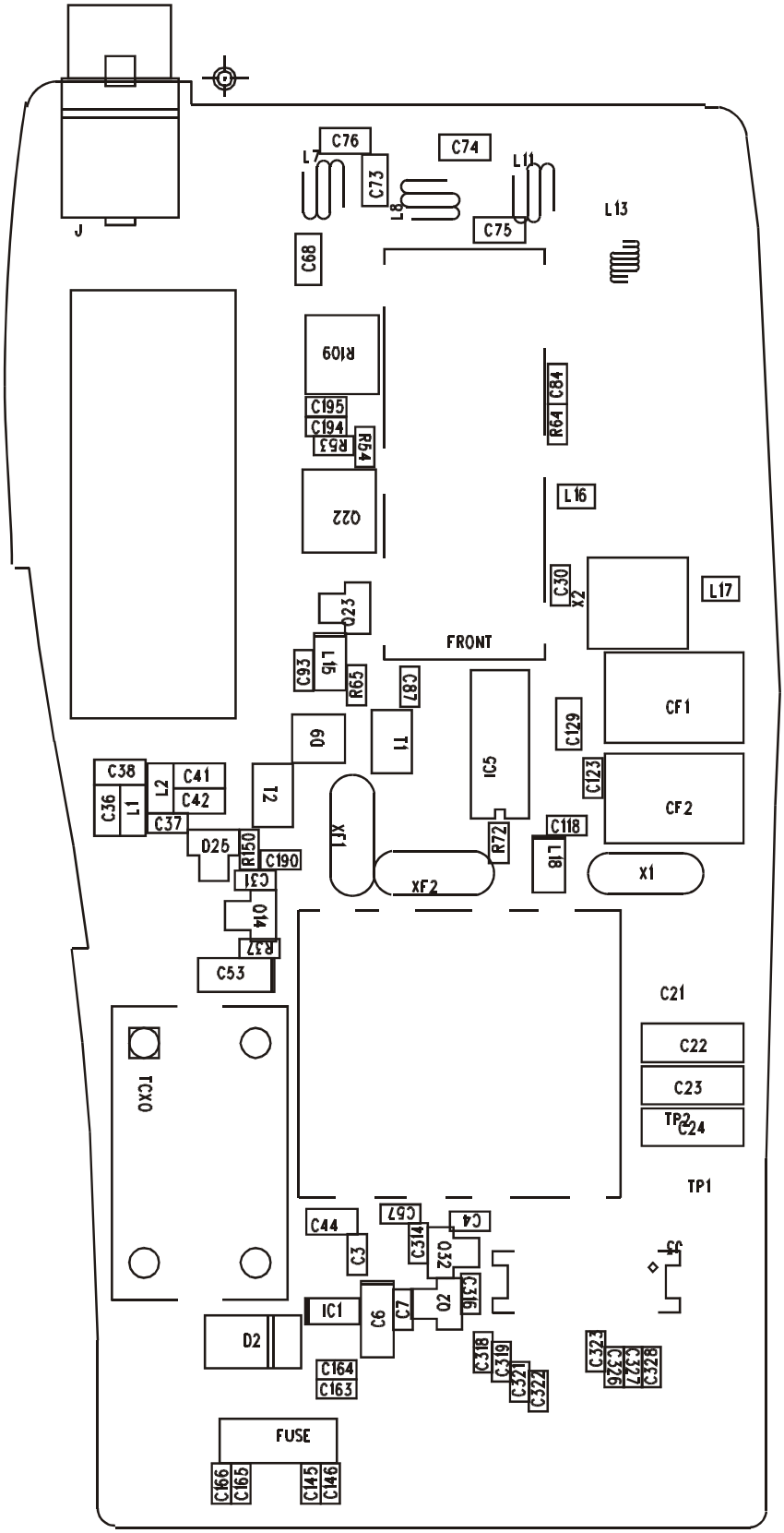


Figure 6-3 - Legend Layout for Top Side of RF PCB

COMPONENT LOCATION – Bottom side of RF pcb

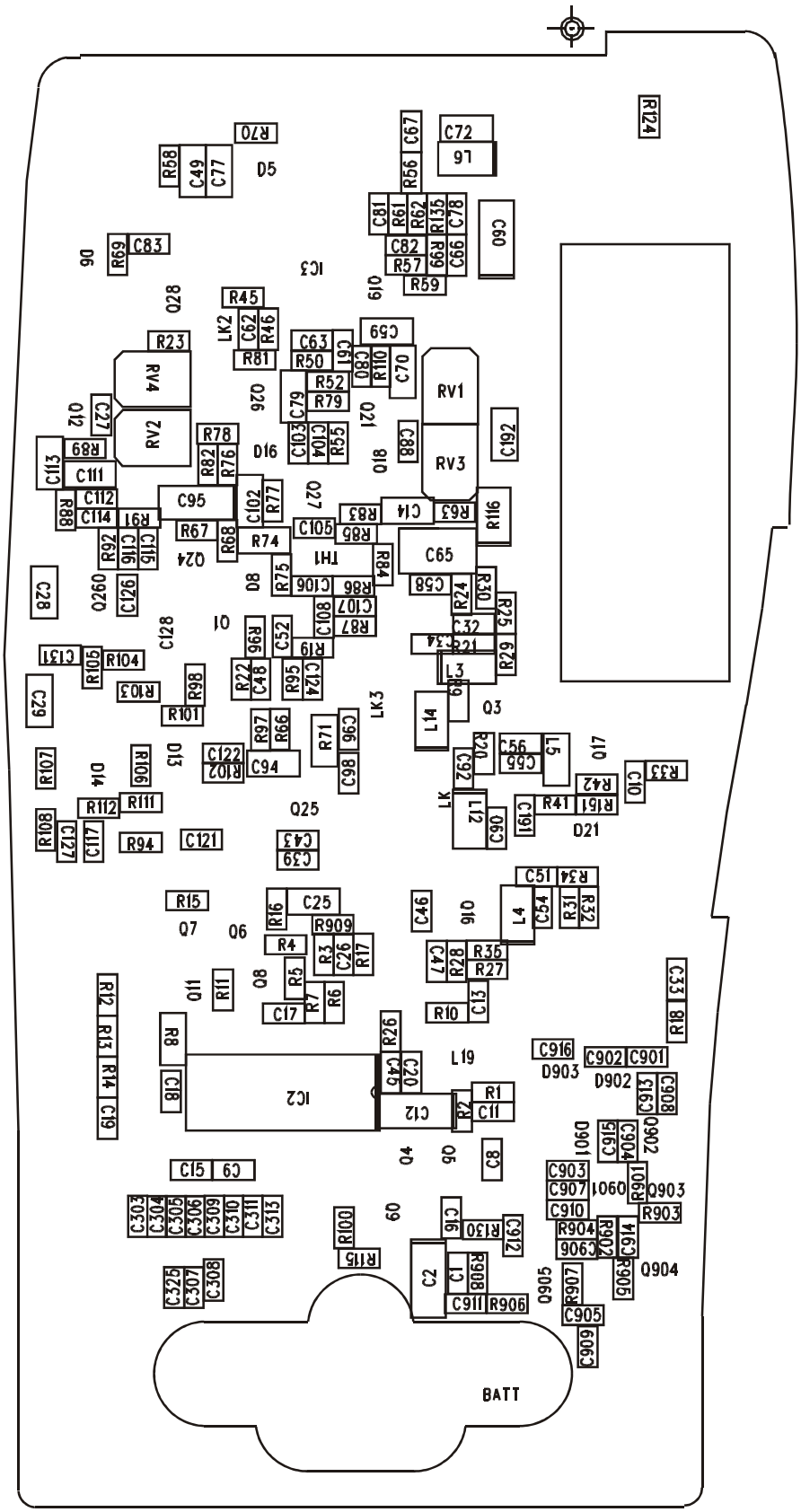


Figure 6-4 - Legend Layout for Bottom Side of RF PCB

7 PROGRAMMING

7.1 SMP6100

7.1.1 Introduction

The SMP6100 allows programming of the SP200/210 radio and enables you to:

1. Program frequencies and built-in signalling operations.
2. Customise radios to your own requirements.

and also provides access to a range of other product features.

Conventions Used

In the following instructions, <enter> means press the Return key. On your keyboard, this may also be called the Enter Key or the Carriage Return Key.

At any menu, <Esc> returns you to the previous menu.

7.1.2 Getting Started

The following items are required to program the SP200/210 radio

SMP6100 software (copied from the Launch Pack CD, or downloaded from Maxon's Website at maxon.co.uk)
Programming cable (25-way D type to radio aux. connector)

To Run SMP6100

Copy the SMP6100 executable file onto your hard drive.
The software may be run from DOS via the hard drive, or within a Windows™ environment.

Ensure that SMP6100 is run in "full screen" mode. This can be achieved by pressing <Alt><enter> at the same time or by clicking on the 4 arrowed box.

Note: It is recommended that a backup of the software diskette is taken. Maxon Europe permit and recommend that a copy be made and stored in a safe place in case of accidental damage or loss.

7.1.3 Programming

Having entered the SMP6100 programmer you are greeted with the front screen. Select the appropriate product.

SP200 (American Version)
SL100 (European Version)

Select the appropriate band.

Having selected a radio, the Setup & Select Data Source Menu is displayed.

Setup & Select Data Source

1. Select Communication Port
2. Read Radio
3. Set Path to Data Files
4. Read Existing File
5. Restore / return to last file
6. Create New File
7. Close

Setting Rx / Tx Frequencies

An 8 digit radio frequency field is displayed. The relevant frequency for Rx and Tx can be entered. Press <enter> to enter values and follow instructions on screen. Press F1 for additional information. Press <Esc> to return to main screen.

Having entered the Rx frequency, and the Channel spacing, the next screen relates to Tone options:

The following sub-menu is displayed:

Select Tone Type
No change
No option
Select CTCSS tone
Non-standard CTCSS tone #1
Non-standard CTCSS tone #2
Select DCS tone
External option

This option allows CTCSS or DCS tone codes to be programmed for each channel. When CTCSS is programmed, only calls with the specified code will be heard. In normal operation, the radio will remain quiet until the correct code is received. The status indicator will glow green, the loudspeaker will open and the call will be heard. DCS works in exactly

the same way except that a digital burst is used instead of any audio tone.

Select one of the tone options for receive operation and press <enter>

Select Features Menu

Having accessed the Personality Programmer Screen and entered your radio's data, press the right arrow key to access the Select Features Menu.

To disable power save mode, press <enter> when in RX delay time.

(Selection of the left arrow key or <Esc> will redisplay the previous menu.)

Scanning:

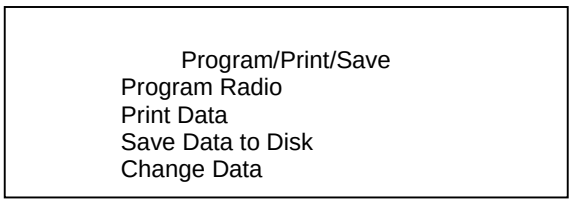
Press <enter> when scanning is highlighted, to select scanning option. Press <F1> for information on scanning routines.

To change scanning parameters and scanning routines, follow instructions on screen. For "All channel scan", no channel information needs to be entered since it will automatically scan all channels. For "Group scan" press <enter> to set up groups. To return to main menu press <esc>.

To set up the scan "group" use the up and down arrow keys and press <space bar> to enable group. To go to screen to allow entering of channels into the group press <enter>. To select the channel use the arrow keys and press <enter>. Only the channels numbers shown in black can be selected, since the channels in white have no frequency information. To return to main menu press <esc>.

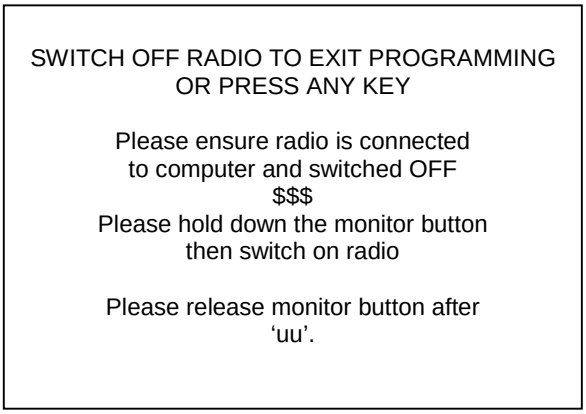
N.B To allow user entry of scan groups (via the keypad), it is necessary to select group scan with an empty group enabled. Using All Channel Scan prevents editing by the user.

Program/Print/Save

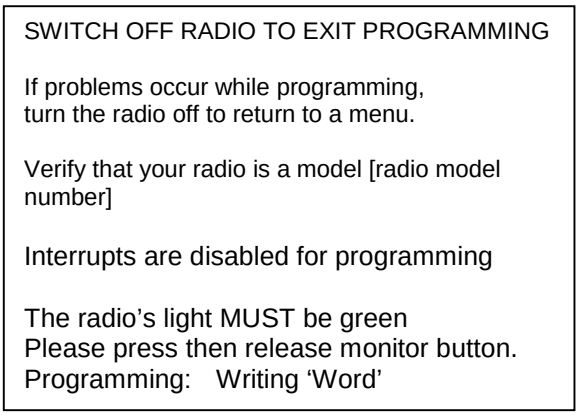


Program Radio

On selection of option 1, the following sub-window is displayed:



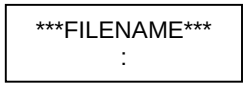
Follow the instructions displayed in the screen window. Once the monitor button has been released after the second LED flash, the following sub-window is displayed:



If problems occur during programming, check you have specified:

- the correct communication port
- the programming leads are all connected
- the radio is fitted with a charged battery

If problems do occur, turn the radio off, on and then off again.
When programming is complete, the following sub-window is displayed:



and the radio scrolls through with the word 'end'.

If the radio data has not previously been saved under a filename, a filename window is displayed. If you wish to save this data to file, type an eight character filename and press <enter>.

Having pressed <enter>, the following sub-window is displayed:

```
Enter record information if desired <CR> to end
```

If you wish to assign some text to the file (i.e. a description of the data type etc.), type it now and press <enter>

The following screen prompt is then displayed at the bottom of the screen:

```
Type a serial number if you want to retrieve this
data by serial no.
Enter Radio Serial No.
```

This function will allow you to recall a data file by serial number alone at a later date.

Having typed the serial number (or <enter> if you do not wish to use this facility), the Program/Print/Save Menu is redisplayed with option 1 now reading “Program another with same data”.

If you wish to program another radio with the same data, select option 1. Otherwise, press <enter> to return to the Select Features Menu.

Print Data

This option produces a print-out of the Personality Programmer data.

The following screen prompt is displayed:

```
Y for Yes will cause a form feed to move
paper to top of page
```

If you wish to use this facility, type Y

Save Data to Disk

This option saves the current data to a file. On selection of option 3, a filename window is then displayed together with the following screen prompt:

```
Type a filename to save this data or <CR> to
use the name shown.
```

If you wish to save this data to another filename, type an eight character filename and press <enter>.

8 EXPLODED MECHANICAL DRAWINGS & PARTS LISTS

8.1 Parts List

The following pages detail the mechanical and electronic parts for the Maxon SL100 radio.
Refer to the following two pages for the exploded diagram.

When using the Parts List, you will notice that each part number has been allocated a category: A, B or C. The definitions of these categories are as follows:

A = An item which is manufactured by Maxon Korea and can be ordered as a stock item.

B = An item which is manufactured in the Far East and can be ordered as a stock item.

C = An item which may be sourced locally and is therefore not available as a stock item.

H = An item which is only available as part of an assembly (see table below) and is therefore not available as a stock item.

8.2 Spare Parts

The following items only are held as replacement parts for the SL100.
Please consult our Web Site price list for price and any additions to the list:

Category	Code & Part No.	Description	Item No.
B	280-110-2	Fuse 60V 4A	
B	420-125-1	Speaker 1W 4 ohms	17
B	420-206-0	Microphone (condenser)	19
B	420-771-3	Jack (3.5mm stereo connector)	22
B	421-197-0	Antenna connector	46
B	421-203-2	Connector (CON404 - between boards)	
B	421-204-3	Connector (CON404 – between boards)	
B	422-470-1	Connector (Speaker/Mic)	
B	422-930-0	Spring connector (Battery terminal)	
B	436-046-5	Switch Tact	27
B	450-528-0	Volume Control (VR5)	
A	508-725-A	Battery Case Assembly	
A	508-726-AA	Upper Cover Assembly	
B	508-727-BA	Back Cover Assembly	
B	508-751-A	Up/Down Switches	20
B	612-081	Screw	29
B	612-306	Screw	65
A	719-655	Bare Upper Cover	1
B	772-427	Front End Shield Can	
B	772-462	Shield Can (PA Shield)	30
B	772-496	Shield Can (Digital Board Shield)	
B	772-497	Shield Can (Rx shield)	
B	826-393	Knob Volume	12
A	826-396	Belt Clip Holder Assembly	59,60,64
B	895-544	PTT Pad	10
B	895-545	Key Pad	4
B	895-546	Dust Cap	2
B	895-547	Option Key	9
B	895-557	Gasket	6
B	895-660	Cushion	73
B	895-661	Cushion	66
B	895-685	Cushion for mic	72
B	895-753	Rubber Cap	

Category	Code & Part No.	Description	Item No.
B	895-754	O-ring	
B	895-763	Con O-ring	
B	906-706	Felt	15
B	906-929	Insulation Plate (speaker)	
B	937-498	Owner's Manual	

SL100U2

Category	Code & Part No.	Description
A	221-325-7	Power Module Assembly
A	568-59C-CA	Control Circuit Assembly
A	568-59F-U2	Front End Assembly
A	568-59L-CD	LCD Module Assembly
A	568-59R-C	RF Circuit Assembly
A	568-59T-CXO	TCXO Assembly
A	568-59V-U2	VCO Assembly

SL100V2

Category	Code & Part No.	Description
A	221-324-6	Power Module Assembly
A	568-58C-CA	Control Circuit Assembly
A	568-58F-V2	Front End Assembly
A	568-58L-CD	LCD Module Assembly
A	586-58R-CA	RF Circuit Assembly
A	568-58T-CXD	TCXO Assembly
A	568-58-V-V2	VCO Assembly

Please note that this section details the complete parts list of the radio. This information is provided for information only and does not imply that these parts are available as spares. Please note the category designation, as described above.

For details on servicing, please refer to Section 10.

8.3 Mechanical Parts

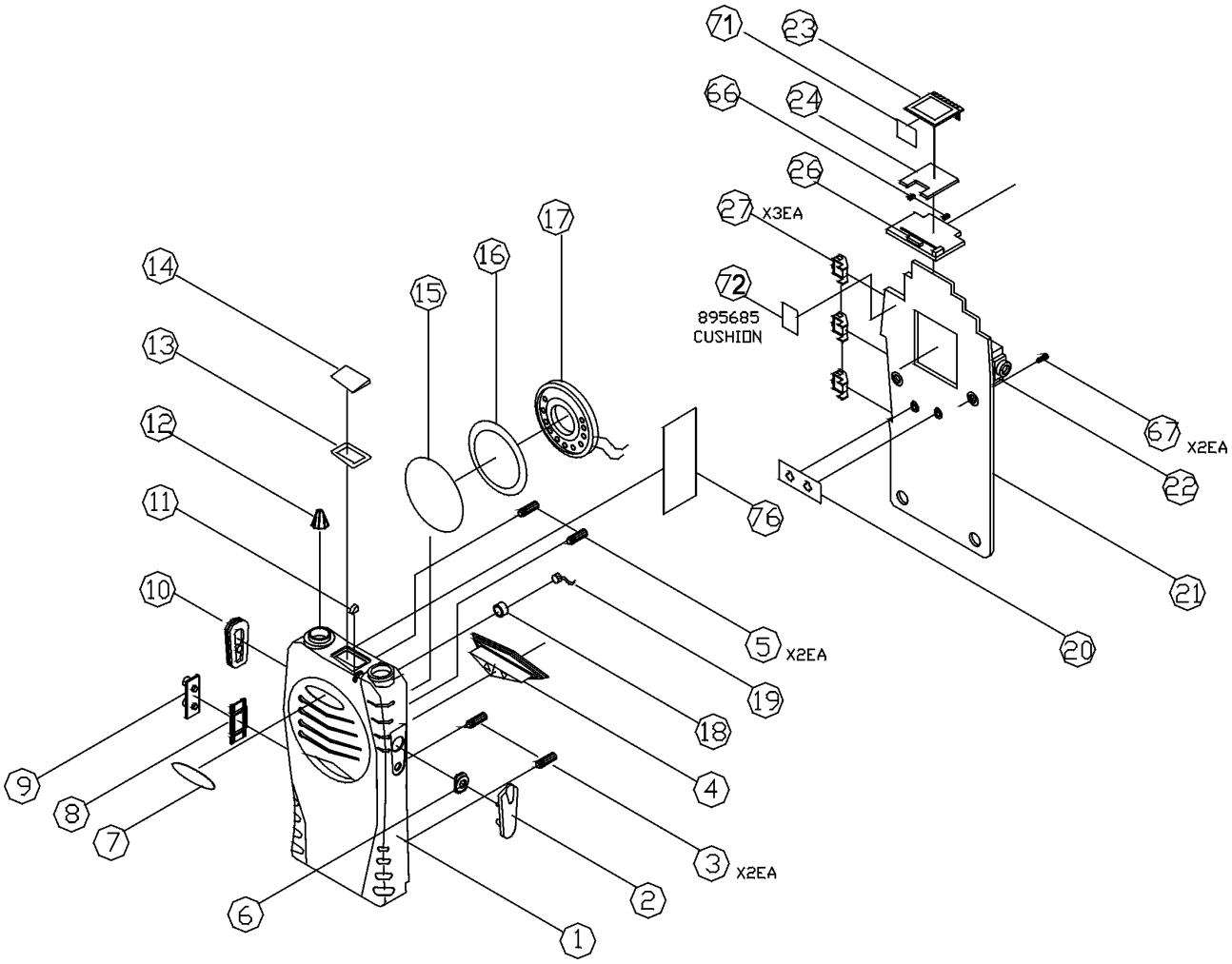


Figure 8-1 - Exploded Mechanical Drawing 1

No.	Part No.	Part Name	Description	Qty
1	719-665-A	Upper Cover	Lexan 141-70456	1
2	895-546	Dust Cap	Silicone Rubber	1
3	853-196	Insert (U/Cover)	BSBM M2x3.5x10.3H	2
4	895-545	Key Pad	Silicone Rubber	1
5	853-197	Insert (U/Cover)	BSBM M2x3.5x14H	2
6	895-557	Gasket	Silicone Rubber	1
7	795-878	Overlay	Lexan T0.25	1
8	723-955	Bracket	SUS T0.4	1
9	895-547	Option Key	Silicone Rubber	1
10	895-544	PTT Pad	Silicone Rubber	1
11	895-550	Lens LED	Silicone Rubber	1
12	826-393	Knob Volume	Lexan 141-70456	1
13	906-923	Double Sided Tape	3M 9448HK T0.16	1
14	814-279	Lens LCD	Acrylic	1
15	906-706	Felt (Spk)	Dia. 32.5mm Felt T0.3mm	1
16	895-490	Gasket	Dia. 39.5 x 0.33 x T1.0 ENA Sponge	1
17	420-125-1	Speaker	4 ohm 1.0W 40mm G-4404	1
18	850-924	Bushing Mic.	Dia. 7.5mm x 5.5H PVC	1
19	420-206-0	Mic. Condenser	WM-063-AT 6 DIA.	1
20	508-751-A	Dome Sw.		1
21	416-097-A	PCB Digital	101.1 x 55.5 x 1.0 FR4 2/S	1
22	420-771-3	Miniature Jack	HSJ-0861-01-410	1
23	252-209-0	LCD	TTR 1866 DPFDPW	1
24	895-589	Back Lighter	13 x 2.6 x T3.2 Silicone Rubber	
76				

Table 8-1 - Parts List for Exploded Mechanical Drawing 1

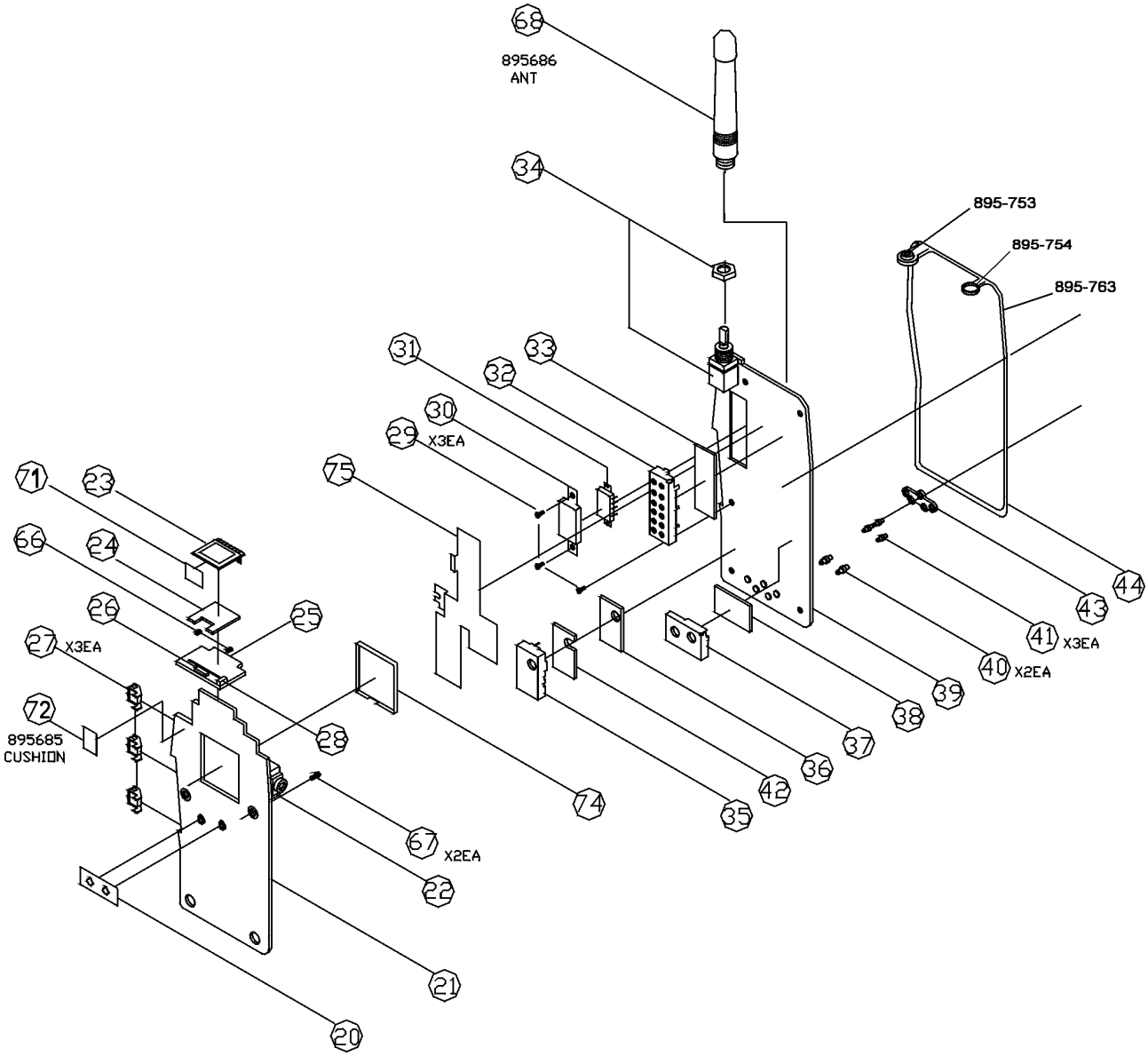


Figure 8-2 - Exploded Mechanical Drawing 2

No.	Part No.	Part Name	Description	Qty
25	406-767-A	PCB LCD	20.6 x 15 x 1.0 FR4 1/1	1
26	252-107-1	LED Display	SLE0022M	1
27	436-046-5	Sw TACT	SKPT-110VA	3
28	251-234-7	LED Chip	SML-020MLTT86 SMD	1
29	612-081	(+) Machine Screw (BH)	M2 x 4 ZN-Plat	3
30	772-462	Shield Can	NSP T0.2	1
31	221-324-6	Power Module		1
32	772-427	Shield Can (Front End)	NSP T0.2	1
33	406-787-A	PCB Front End	27 x 10 x 0.8 FR4 1/1	1
34	651-156	NUT	M7 BSBM	1
35	772-429	Shield Can (TCXO)	BSP T0.25 NI-PLAT	1
36	406-785-A	PCB TCXO	19 x 11 x 1.0 FR4 1/1	1

37	772-428	Shield Can (VCO)	NSP T0.2	1
38	406-764-B	PCB VCO	21 x 18 x 0.8 FR4 1/1	1
39	416-096-A	PCB RF	99 x 53.3 x 1.0 FR4 2/S	1
40	422-930-0	Spring Coil		2
41	753-049	Terminal	BSBM Gold-Plat	3
42	906-542	Insulation Plate	Fiber T0.3	1
43	895-549	Terminal Gasket	Silicone Rubber	1
44	895-763	Ring Gasket	Silicone Rubber	1
	895-753	Volume Control O Ring		1
	895-754	Antenna Control O Ring		1
66	895-661	Cushion	10 x 2.5 x 1.0 T EVA Sponge	1
67	600-804	Plastic Screw (Mic)	M1.8 x 5	2
71	906-939	Double Sided Tape	For Battery 24 x 33 x T0.4	1
72	895-685	Cushion		1
73	895-660	Cushion	15 x 9 x 1.0T EVA Sponge	1
74	772-496	Shield		1
75	772-497	Shield		1

Table 8-2 - Parts List for Exploded Mechanical Drawing 2

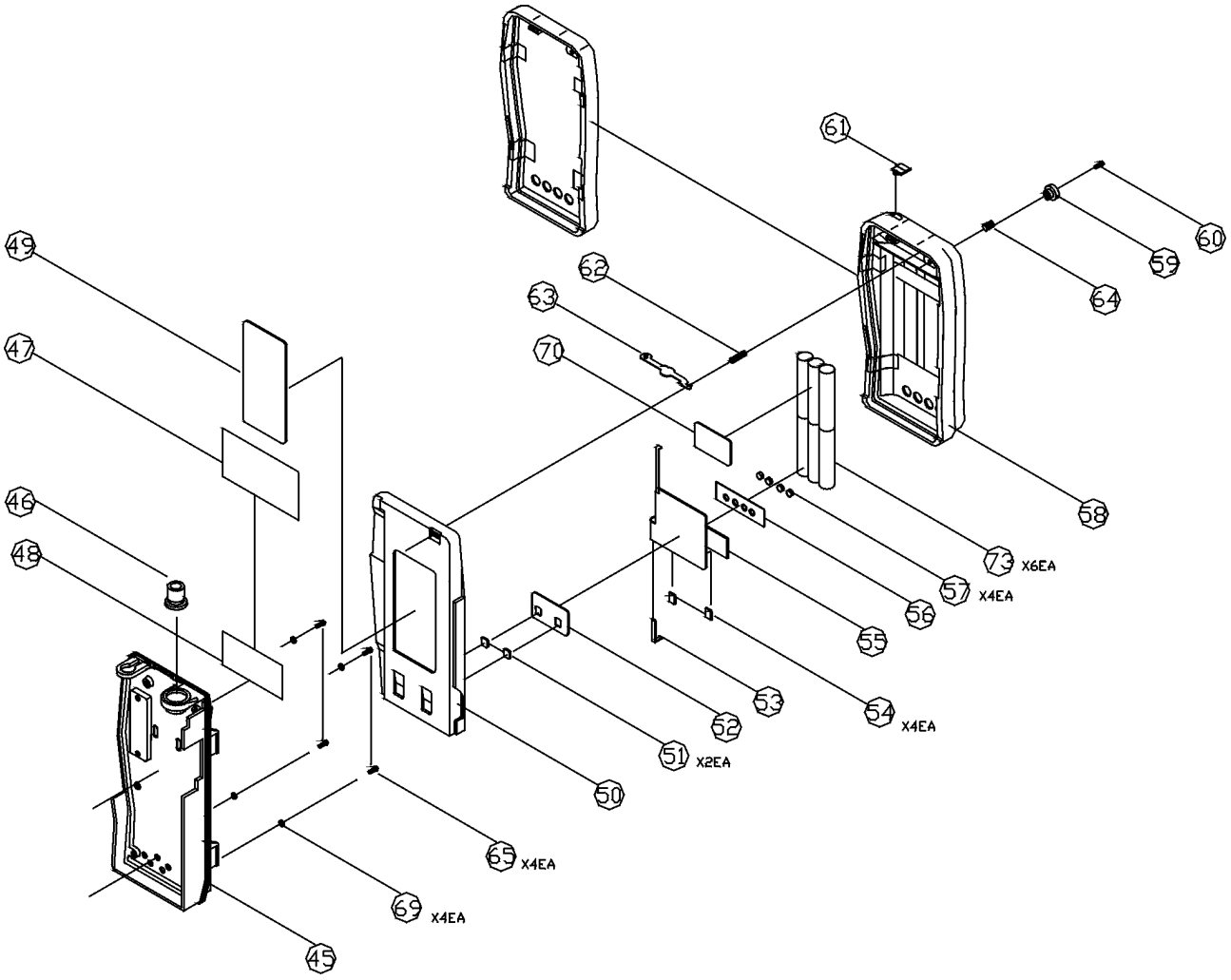


Figure 8-3 – Exploded Mechanical Drawing 3

No.	Part No.	Part Name	Description	Qty
45	719-656	Cover Back	ALDC	1
46	421-197-0	Connector ANT	SMA-P(M) SW-2449	1
47	959-046-B	Label Name	Polyester 39.5 x 20.5	1
48	95A-177-A	Label FCC No.	Polyester 39.5 x 14.5	1
49	95A-670	Label Battery	Yupo Paper 25.5 x 49.5	1
50	719-657	Cover Battery	Lexan 141-70456	1
51	752-958	Terminal	BSP T1.2 Gold Plate	2
52	906-858	Double Sided Tape	32 x 17 x T0.4 TESA 4976	1
53	752-808	Contact Plate	18 x T0.15 Ni-Plate (DPB-1190A)	5
54	753-061	Spacer (For Battery)	ABS94HB- L401-9001	
55	406-766-A	PCB Battery	38.2 x 87.6 x 0.5 M1 FLEX 1/0	1
56	906-857	Double Sided Tape	34 x 10 x T0.4 TESA 4976	1
57	753-037	Terminal	BSBM Gold Plate	4
58	719-659	Battery Pack (1350mAH)	Lexan 141-70456	1
59	732-975	Holder	PC Lexan 141-70456	1
60	611-388	(+) Machine Screw (PH)	M2.6 x 6 (+) PH	1
61	826-395	Knob Latch (1350mAH)	Lexan 141-70456	1
62	881-656	Spring (For Latch)	SUS 304 WPA Dia. 0.3	1
63	826-396	Latch	SUS T1.0	1
64	853-170	Insert (Holder)	BSBM M2.6	1
65	612-306	(+) Machine Screw	(BH) M2 x 5 Zn-Plate	4
68	895-686	Gasket		1
70	895-452	Gasket Ring	Silicone Rubber Black	4
73	895-660	Cushion	15 x 9 x 1.0T EVA Sponge	1

8.4 SL100 VHF Parts List

8.4.1 V2 Control Circuit

Category	Code & Part No.	Description	Qty	Location
C	**05B-000-5Z**	CHIP RESISTOR 0 1/16W 5% T 1608	10	RLK4.7.8.11. 15.22.26.29.3 0.34
C	05B-100-2Z	CHIP RESISTOR 10 1/16W 5% T 1608	1	R466
C	05B-102-4Z	CHIP RESISTOR 1K 1/16W 5% T 1608	1	R490
C	05B-103-5Z	CHIP RESISTOR 10K 1/16W 5% T 1608	4	R403.413.430 .440
C	05B-104-6Z	CHIP RESISTOR 100K 1/16W 5% T 1608	9	R409.454.455 .456.457.458 459 460 461.
C	05B-105-7Z	CHIP RESISTOR 1M 1/16W 5% T 1608	2	R408.445
C	05B-124-4Z	CHIP RESISTOR 120K 1/16W 5% T 1608	4	R441.486.405 .428
C	05B-152-9Z	CHIP RESISTOR 1.5K 1/16W 5% T 1608	1	R416
C	05B-153-0Z	CHIP RESISTOR 15K 1/16W 5% T 1608	1	R421
C	05B-154-1Z	CHIP RESISTOR 150K 1/16W 5% T 1608	1	R(LK18)
C	05B-183-7Z	CHIP RESISTOR 18K 1/16W 5% T 1608	1	R422
C	05B-202-1Z	CHIP RESISTOR 2K 1/16W 5% T 1608	1	R435
C	05B-203-2Z	CHIP RESISTOR 20K 1/16W 5% T 1608	2	R491.492
C	05B-204-3Z	CHIP RESISTOR 200K 1/16W 5% T 1608	1	R438
C	05B-220-7Z	CHIP RESISTOR 22 1/16W 5% T 1608	2	R477.482
C	05B-222-9Z	CHIP RESISTOR 2.2K 1/16W 5% T 1608	2	R424.483
C	05B-223-0Z	CHIP RESISTOR 22K 1/16W 5% T 1608	3	R412.470.RL K27
C	05B-224-1Z	CHIP RESISTOR 220K 1/16W 5% T 1608	2	R404.464
C	05B-273-5Z	CHIP RESISTOR 27K 1/16W 5% T 1608	3	R425.427.429
C	05B-331-4Z	CHIP RESISTOR 330 1/16W 5% T 1608	1	R484
C	05B-334-7Z	CHIP RESISTOR 330K 1/16W 5% T 1608	2	R471.488
C	05B-363-3	CHIP RESISTOR 36K 1/16W 5% T 1608	1	R420
C	05B-393-0Z	CHIP RESISTOR 39K 1/16W 5% T 1608	1	R472
C	05B-472-8Z	CHIP RESISTOR 4.7K 1/16W 5% T 1608	3	R401.443.444
C	05B-473-9Z	CHIP RESISTOR 47K 1/16W 5% T 1608	13	R407.410.411 .415.419.432. 433.450.451. 467.473.474. 475
C	05B-513-2	CHIP RESISTOR 51K 1/16W 5% T 1608	3	R418.436.489
C	05B-561-5Z	CHIP RESISTOR 560 1/16W 5% T 1608	1	R402
C	05B-682-1Z	CHIP RESISTOR 6.8K 1/16W 5% T 1608	1	R406
C	05B-683-2Z	CHIP RESISTOR 68K 1/16W 5% T 1608	1	R426
C	05B-752-1Z	CHIP RESISTOR 7.5K 1/16W 5% T 1608	1	R487
C	05B-753-2Z	CHIP RESISTOR 75K 1/16W 5% T 1608	1	R423
C	05B-823-2Z	CHIP RESISTOR 82K 1/16W 5% T 1608	1	R493
C	130-A01-7Y	CHIP CERAMIC 0.015UF GRM39 X7R153K 25V P	1	C494
C	130-A49-5Y	CHIP CERAMIC 0.0018UF GRM39 X7R182K 50V P	1	C495
C	130-A73-6Y	CHIP CERAMIC 0.01UF GRM39 X7R103K 25V	1	C402
C	130-A74-7Y	CHIP CERAMIC 0.1UF GRM39 Y5V104Z 25V P	10	C401.408.422 .423.431. 451 452 453 486 490

Category	Code & Part No.	Description	Qty	Location
C	130-A75-8Y	CHIP CERAMIC 0.001UF GRM39 X7R102K 50V P	2	C415.445
C	130-A99-0Y	CHIP CERAMIC 0.012UF GRM39 X7R123K 25V P	1	C436
C	130-249-9	CHIP CERAMIC 0.0022UF GRM39 X7R222J 50V P	1	C418
C	130-261-9Y	CHIP CERAMIC 0.022UF GRM39 X7R223K 50V P	1	C421
C	130-340-7Y	CHIP CERAMIC 0.0033UF GRM39 X7R332K 50V P	1	C432
C	130-432-7Y	CHIP CERAMIC 0.0047UF GRM39 X7R472K 50V P	2	C488.489
C	130-529-2	CHIP CERAMIC 0.056UF GRM39 X7R563K 16V	1	C444
C	130-624-4	CHIP CERAMIC 0.68UF GRM40 Y5V684Z 16V P	1	C425
C	131-089-7Y	CHIP CERAMIC 1UF GRM40 Y5V105Z 16V P	3	C433.434.435
C	131-089-9Y	CHIP CERAMIC 1UF GRM426Y5V105Z 16V P	1	C416
C	131-100-6Y	CHIP CERAMIC 0.1UF GRM39 X7R104K 50V P	5	C403.414.427 .487.404
C	131-564-8Y	CHIP CERAMIC 15PF GRM39 COG150J 50V P	2	C428.429
C	132-260-8Y	CHIP CERAMIC 220PF GRM39 COG221J 50V P	5	C438.439.440 .441.493
C	134-770-2Y	CHIP CERAMIC 470PF GRM39 X7R471K 50V P	9	C405.407.410 .411.412.413. 419 437 447
C	136-840-2Y	CHIP CERAMIC 680PF GRM39 X7R681K 50V P	1	C424
C	141-052-5Z	CHIP TANTALUM 100UF 293D107X0006E2T6V	1	C442
C	141-059-2	CHIP TANTALUM 10UF 293D106X06R3A2T6.3V	4	C406.420.430 .454
C	144-720-0Z	CHIP TANTALUM 4.7UF 293D475X0020C2T20V	1	C443
C	144-722-2Z	CHIP TANTALUM 4.7UF 293D475X0010A2T10V	5	C417.446.450 .491.492
C	202-085-9Z	TRANSISTOR KRC101SNA	1	Q402
C	202-092-5	BRT KRA110SPK	1	Q401
C	202-095-8Z	TRANSISTOR KRC104SND	6	Q404.406.40 8.414.415.41 6
C	202-106-5	TRANSISTOR KTA1504SY	1	Q405
C	218-039-1Z	TRANSISTOR KRA101S	1	Q403
C	221-196-7	I.C EEPROM X25330SI (SOIC8PIN)	1	IC404
C	221-203-0	I.C AUDIO AMP TDA7233D (SO-8)	1	IC402
C	221-204-1	I.C OTP HD6473837UX	1	IC403
C	221-492-4	I.C ASIC MSIMXA	1	IC406
C	222-018-5A	I.C KIA324F-EL	1	IC408
C	223-224-9	I.C MC14066BDR2:SO14	1	IC401
C	231-064-4	I.C OP AMP LM358MX	1	IC407
C	243-051-5	DIODE SI CHIP KDS184S	1	D404
C	243-052-6	DIODE SI CHIP KDS193	1	D403
C	243-063-6	DIODE SWITCHING KDS181S A3	2	D401.402
C	262-775-7	CRYSTAL CHIP 3.579545M 50PM 12P	1	X401
C	310-659-2	COIL CHIP 10UH:LER015T100K	1	L401
C	4A6-090-E	P.C.B ASS'Y 125.1X113 X1.0 FR4 2/S	1	
C	406-767-B	P.C.B LCD 20.7 X15 X1.0 FR4 2/S	1	
C	416-097-E	P.C.B DIGITAL 101.1X55.5 X1.0 FR4 2/S	1	
C	420-771-3	JACK MINIATURE HSJ-0861-01-410	1	J401

Category	Code & Part No.	Description	Qty	Location
C	421-203-2	CONNECTOR DF15(6.2)-30DP-0.65V(51)	1	CON404
C	422-470-1	CONNECTOR WAFER 53048-0410 1.25W/B	1	CON401
C	436-046-5	SW TACT SKPT-1101VA	3	SW402.403.405

8.4.2 V2 RF

Category	Code & Part No.	Description	Qty	Location
C	05B-000-5Z	CHIP RESISTOR 0 1/16W 5% T 1608	5	R124.LK3.D903.C10.Q17
C	05B-100-2Z	CHIP RESISTOR 10 1/16W 5% T 1608	2	R79.908
C	05B-101-3Z	CHIP RESISTOR 100 1/16W 5% T 1608	7	R11.15.66.88.97.130.26
C	05B-102-4Z	CHIP RESISTOR 1K 1/16W 5% T 1608	4	R54.71.86.94
C	05B-103-5Z	CHIP RESISTOR 10K 1/16W 5% T 1608	8	R1.53.82.98.103.104.106.111
C	05B-104-6Z	CHIP RESISTOR 100K 1/16W 5% T 1608	1	R2
C	05B-105-7Z	CHIP RESISTOR 1M 1/16W 5% T 1608	1	R50
C	05B-121-1Z	CHIP RESISTOR 120 1/16W 5% T 1608	1	R21
C	05B-122-2Z	CHIP RESISTOR 1.2K 1/16W 5% T 1608	2	R37.55
C	05B-123-3Z	CHIP RESISTOR 12K 1/16W 5% T 1608	1	R17
C	05B-151-8Z	CHIP RESISTOR 150 1/16W 5% T 1608	1	R63
C	05B-152-9Z	CHIP RESISTOR 1.5K 1/16W 5% T 1608	1	R96
C	05B-180-4Z	CHIP RESISTOR 18 1/16W 5% T 1608	2	R25.34
C	05B-182-6Z	CHIP RESISTOR 1.8K 1/16W 5% T 1608	4	R4.5.7.22
C	05B-183-7Z	CHIP RESISTOR 18K 1/16W 5% T 1608	2	R83.84
C	05B-202-1Z	CHIP RESISTOR 2K 1/16W 5% T 1608	1	R6
C	05B-220-7Z	CHIP RESISTOR 22 1/16W 5% T 1608	5	R23.24.41.64.89
C	05B-222-9Z	CHIP RESISTOR 2.2K 1/16W 5% T 1608	5	R3.18.46.901.902
C	05B-223-0Z	CHIP RESISTOR 22K 1/16W 5% T 1608	8	R45.67.68.76.77.102.105.112
C	05B-224-1Z	CHIP RESISTOR 220K 1/16W 5% T 1608	1	R72
C	05B-271-3Z	CHIP RESISTOR 270 1/16W 5% T 1608	2	R56.110
C	05B-272-4Z	CHIP RESISTOR 2.7K 1/16W 5% T 1608	7	R13.14.78.81.92.150.151
C	05B-273-5Z	CHIP RESISTOR 27K 1/16W 5% T 1608	2	R905.907
C	05B-301-7Z	CHIP RESISTOR 300 1/16W 5% T 1608	4	R29.30.31.32
C	05B-332-5Z	CHIP RESISTOR 3.3K 1/16W 5% T 1608	3	R12.52.95
C	05B-390-7Z	CHIP RESISTOR 39 1/16W 5% T 1608	1	R59
C	05B-391-8Z	CHIP RESISTOR 390 1/16W 5% T 1608	1	R10
C	05B-393-0Z	CHIP RESISTOR 39K 1/16W 5% T 1608	1	R85
C	05B-471-7Z	CHIP RESISTOR 470 1/16W 5% T 1608	2	R91.909
C	05B-472-8Z	CHIP RESISTOR 4.7K 1/16W 5% T 1608	2	R27.903
C	05B-473-9Z	CHIP RESISTOR 47K 1/16W 5% T 1608	2	R75.115
C	05B-474-0Z	CHIP RESISTOR 470K 1/16W 5% T 1608	4	R58.69.70.87
C	05B-475-1Z	CHIP RESISTOR 4.7M 1/16W 5% T 1608	1	R135
C	05B-510-9Z	CHIP RESISTOR 51 1/16W 5% T 1608	1	R65
C	05B-512-1Z	CHIP RESISTOR 5.1K 1/16W 5% T 1608	1	R20
C	05B-513-2	CHIP RESISTOR 51K 1/16W 5% T 1608	1	R19
C	05B-560-4Z	CHIP RESISTOR 56 1/16W 5% T 1608	1	R28
C	05B-562-6Z	CHIP RESISTOR 5.6K 1/16W 5% T 1608	1	R9
C	05B-752-1Z	CHIP RESISTOR 7.5K 1/16W 5% T 1608	2	R904.906
C	05B-822-1Z	CHIP RESISTOR 8.2K 1/16W 5% T 1608	1	R35
C	05B-911-8Z	CHIP RESISTOR 910 1/16W 5% 1608	2	R8.16

Category	Code & Part No.	Description	Qty	Location
C	05C-104-6Z	CHIP RESISTOR 100K 1/16W 1% T 1608	2	R57.99
C	05C-683-2Z	CHIP RESISTOR 68K 1/16W 1% T 1608	2	R61.62
C	06F-108-3	CHIP RESISTOR 0.1 1W 1% 1218	1	R109
C	060-153-3Z	CHIP RESISTOR 15K 1/10W 5% T 2012	1	R116
C	060-203-5Z	CHIP RESISTOR 20K 1/10W 5% T 2012	1	R74
C	075-102-5	RES.CHIP TRIMMER 1K RH03E1C13X	2	RV2.4
C	075-103-6	RES.CHIP TRIMMER 10K RH03E1C14X	2	RV1.3
C	098-333-8	THERMISTOR CHIP 33K:NTCCS32163SH333KC	1	TH1
C	101-058-9	ELECT CAPACITOR 10UF 16V 20% 3X5	1	C129
C	130-A17-6Y	CHIP CERAMIC 0.001UF GRM40 X7R102K 50V P	2	C68.77
C	130-A60-4Y	CHIP CERAMIC 0.1UF GRM40 X7R104K 25V P	4	C79.102.111.113
C	130-A73-6Y	CHIP CERAMIC 0.01UF GRM39 X7R103K 25V	21	C13.27.63.96.106.114.116.123.126.127.131.901 904.910.911 902.903.915.916
C	130-A74-7Y	CHIP CERAMIC 0.1UF GRM39 Y5V104Z 25V P	8	C11.15.17.26.30.88.195.907
C	130-A75-8Y	CHIP CERAMIC 0.001UF GRM39 X7R102K 50V P	10	C18.98.104.122.145.164.67.54.191 194
C	130-250-9	CHIP CERAMIC 0.0027UF GRM39 X7R272J 50V P	1	C108
C	130-341-8Y	CHIP CERAMIC 0.033UF GRM39 X7R333K 16V P	1	C112
C	130-443-7	CHIP CERAMIC 0.47UF GRM40 Y5V474Z 16V P	1	C59
C	131-089-7Y	CHIP CERAMIC 1UF GRM40 Y5V105Z 16V P	7	C14.25.28.29.70.94.192
C	131-092-8Y	CHIP CERAMIC 10PF GRM39 COG100D 50V P	3	C107.121.45
C	131-093-9Y	CHIP CERAMIC 100PF RM39 COG101J 50V P	1	C52
C	131-100-6Y	CHIP CERAMIC 0.1UF GRM39 X7R104K 50V P	2	C48.124
C	131-240-5Y	CHIP CERAMIC 12PF GRM39 COG120J 50V P	3	C10.83.90
C	131-404-7Y	CHIP CERAMIC 14PF GRM40 COG140J 50V P	1	C36
C	131-405-8Y	CHIP CERAMIC 14PF GRM39 COG140J 50V P	1	C92
C	131-816-6Y	CHIP CERAMIC 18PF GRM40 COG180J 50V P	1	C72
C	132-012-1Y	CHIP CERAMIC 20PF GRM40 COG200J 50V P	1	C38
C	132-025-3Y	CHIP CERAMIC 20PF GRM39 COG200J 50V P	1	C32
C	132-259-8Y	CHIP CERAMIC 22PF GRM39 COG220J 50V P	1	C87
C	132-260-8Y	CHIP CERAMIC 220PF GRM39 COG221J 50V P	26	C19.31.115.146.165.303.304.
C				307-311.314.316.319.321. +
C				322.323.325.326.327.328.905.
C				906.318.190
C	132-714-2Y	CHIP CERAMIC 27PF GRM40 COG270J 50V P	1	C75
C	133-349-1Y	CHIP CERAMIC 33PF GRM39 COG330J 50V P	4	C37.51.118.908
C	133-350-1Y	CHIP CERAMIC 330PF GRM39 COG331J 50V P	1	C9

Category	Code & Part No.	Description	Qty	Location
C	133-932-7Y	CHIP CERAMIC 39PF GRM40 COG390J 50V P	1	C73
C	134-301-1Y	CHIP CERAMIC 43PF GRM40 COG430J 50V P	1	C74
C	134-757-1Y	CHIP CERAMIC 47PF GRM39 COG470J 50V P	4	C105.117.163 .166
C	134-770-2Y	CHIP CERAMIC 470PF GRM39 X7R471K 50V P	21	C1.3- 4.7.8.20.33,4. 47.55.57,8.
C				61.62.66.78.8 0-82.84.103.
C	135-021-4Y	CHIP CERAMIC 5PF GRM39 COG050C 50V P	1	C46
C	135-103-5Y	CHIP CERAMIC 51PF GRM40 COG510J 50V P	1	C42
C	136-014-3Y	CHIP CERAMIC 6PF GRM39 COG060D 50V P	2	C16.56
C	138-011-0Y	CHIP CERAMIC 8PF GRM39 COG080D 50V P	1	C43
C	138-232-3Y	CHIP CERAMIC 82PF GRM39 COG820J 50V P	1	C93
C	141-046-0Z	CHIP TANTALUM 10UF 293D106X0010B2T10V	1	C65
C	141-059-2	CHIP TANTALUM 10UF 293D106X06R3A2T6.3V	2	C2.12
C	144-722-2Z	CHIP TANTALUM 4.7UF 293D475X0010A2T10V	5	C6.53.60.95.1 28
C	180-126-6	METAL POLY CAP 0.01UF 103K 63V BOX	2	C23.24
C	180-209-8	METAL POLY CAP 0.022UF 223K 63V BOX	1	C22
C	180-609-6	METAL POLY CAPACITOR0.68UF MKT370 63V	1	C21
C	200-003-5	TRANSISTOR BFR92A REEL	1	Q25
C	200-113-1	TRANSISTOR KTC4075	4	Q901.903.90 4.905
C	200-114-2	TRANSISTOR KTA2014	1	Q902
C	202-092-5	BRT KRA110SPK	4	Q2.4.9.32
C	202-095-8Z	TRANSISTOR KRC104SND	6	Q12.18.23.24 .28.260
C	202-106-5	TRANSISTOR KTA1504SY	2	Q7.8
C	202-113-1	TRANSISTOR KTC3875S(BL)	7	Q6.11.14.19. 21.26.27
C	202-116-4	TRANSISTOR KTA1663	1	Q22
C	203-181-7	TRANSISTOR MMBR951:SOT23	2	Q3.16
C	218-057-7Z	TRANSISTOR KRA104S	2	Q1.5
C	220-028-4	I.C REGULATOR TK11450MTR	1	IC1
C	221-324-6	RE POWER MODULE GNOK-M68776-E01	1	IC9
C	221-529-5	I.C PLL MC145193F (SO-20)	1	IC2
C	223-453-9	I.C FM IF MC3372D (SO-16) (MOB.80	1	IC5
C	231-064-4	I.C OP AMP LM358MX	1	IC3
C	243-012-0	DIODE MMBV3401LT1	2	D21.25
C	243-049-4Z	DIODE CHIP KDS226	3	D901.902.903
C	243-052-6	DIODE SI CHIP KDS193	2	D8.16
C	243-063-6	DIODE SWITCHING KDS181S A3	3	D13.14
C	243-087-8	DIODE CHIP UPP9401(T&R)50V 2.5W	2	D5.6
C	243-122-6	SCHOTTKY DIODE HSMS-2817 #L31	1	D9
C	245-040-5	DIODE REC CHIP SM4004 1A 400V SMD	1	D2
C	263-418-0	CRYSTAL NR2D 44.645M -30 15PM 32P 3R	1	X1
C	270-109-9	FILTER CERAMIC CFWM455F	1	CF1
C	270-314-7	DISCRIMINATOR CDBC455CX16-TC	1	X2
C	270-316-9	FILTER CERAMIC LTWM455HT	1	CF2
C	271-165-4	CRYSTAL FILTER 45Y15BN 45.1MHZ	1	XF1
C	280-110-2	FUSE 60 V 4 A 25NM-040-L REEL:SM	1	FUSE1
C	300-223-8	TRANSFORMERS CHIP 617PT-1019	2	T1.2
C	310-659-2	COIL CHIP 10UH:LER015T100K	1	L19
C	310-861-7	COIL CHIP 47NH:LL2012-F47NM	2	L1.2
C	311-067-2	COIL CHIP 0.1UH:NL252018T-R10J	2	L3.4

Category	Code & Part No.	Description	Qty	Location
C	311-069-4	COIL CHIP 0.15UH:NL252018T-R15J	1	L15
C	311-077-1	COIL CHIP 0.68UH:NL252018T-R68J	1	L14
C	311-079-3	COIL CHIP 1.0UH:NL252018T-1R0J	2	L6.18
C	311-170-1	COIL CHIP 1000UH:300SS-102K=CP3	2	L16.17
C	311-297-3	COIL SPRING 3X0.55X5T:L SMD	2	L8.11
C	311-298-4	COIL SPRING 3X0.55X4T:L SMD	1	L7
C	311-323-3	COIL SPRING 2.8X0.4X8T:L	1	L13
C	416-096-C	P.C.B RF 99 X53.3 X1.0 FR4 2/S	1	
C	421-204-3	CONNECTOR DF15(0.8)-30DS-0.65V(51)	1	J1
C	422-930-0	SPRING CONNECTOR GW9803302	2	CON1.9
C	450-528-0	VR 20KA TP76NOON	1	VR5

8.4.3 TCXO Assembly

Category	Code & Part No.	Description	Qty	Location
C	05B-102-4Z	CHIP RESISTOR 1K 1/16W 5% T 1608	1	R10
C	05B-103-5Z	CHIP RESISTOR 10K 1/16W 5% T 1608	1	R9
C	05B-104-6Z	CHIP RESISTOR 100K 1/16W 5% T 1608	2	R13.15
C	05B-122-2Z	CHIP RESISTOR 1.2K 1/16W 5% T 1608	1	R1
C	05B-152-9Z	CHIP RESISTOR 1.5K 1/16W 5% T 1608	1	R16
C	05B-154-1Z	CHIP RESISTOR 150K 1/16W 5% T 1608	1	R4
C	05B-203-2Z	CHIP RESISTOR 20K 1/16W 5% T 1608	1	R2
C	05B-393-0Z	CHIP RESISTOR 39K 1/16W 5% T 1608	1	R5
C	05B-473-9Z	CHIP RESISTOR 47K 1/16W 5% T 1608	4	R7.8.12.14
C	05B-563-7Z	CHIP RESISTOR 56K 1/16W 5% T 1608	2	R6.11
C	05B-564-8Z	CHIP RESISTOR 560K 1/16W 5% T 1608	1	R3
C	097-103-6	THERMISTER CHIP 10K NTCCM20123NH103JCT	1	TH1
C	097-473-6	THERMISTOR CHIP NTCCM 16084LH 473JC 47K	1	TH2
C	130-A74-7Y	CHIP CERAMIC 0.1UF GRM39 Y5V104Z 25V P	1	C3
C	131-137-6Y	CERAMIC CHIP 100PF GRM39 U2J101J 50V	1	C2
C	131-564-8Y	CHIP CERAMIC 15PF GRM39 COG150J 50V P	1	C1
C	132-275-2	CHIP CERAMIC 22PF GRM39 U2J220J 50V P	1	C5
C	132-735-1Y	CHIP CERAMIC 270PF GRM39 COG271J 50V P	1	C6
C	134-012-1Y	CHIP CERAMIC 4PF GRM39 COG040C 50V P	1	C4
C	172-021-1	TRIMMER 20PF TZC03P200A110	1	CT1
C	202-082-6	TRANSISTOR KTA1504ST1(G)	1	Q2
C	202-112-0	TRANSISTOR KTC3875S(GR)	2	Q3.4
C	202-153-7	TRANSISTOR KTC3880SY	1	Q1
C	242-011-4	DIODE VARICAP MMBV109	1	D1
C	242-025-7	DIODE VARACTOR CHIP HVU300ATRU 30V	1	D2
C	263-374-3	CRYSTAL CA303HS 12.8MHZ 3PPM 14PF	1	X1
C	406-785-A	P.C.B TCXO 19X11X0.8T FR4	1	
C	772-429	SHIELD CAN(TCXO) BSP T0.25 NI-PLATE	1	
C	860-172	PIN TCXO PIN BRASS TIN PLATED	4	PIN
C	906-542	INSULATION PLATE FIBER T0.3	1	

8.4.4 V2 VCO

Category	Code & Part No.	Description	Qty	Location
C	05B-101-3Z	CHIP RESISTOR 100 1/16W 5% T 1608	1	R202
C	05B-103-5Z	CHIP RESISTOR 10K 1/16W 5% T 1608	1	R201
C	05B-104-6Z	CHIP RESISTOR 100K 1/16W 5% T 1608	1	R203
C	05B-201-0Z	CHIP RESISTOR 200 1/16W 5% T 1608	1	R209
C	05B-222-9Z	CHIP RESISTOR 2.2K 1/16W 5% T 1608	2	R206.207
C	05B-472-8Z	CHIP RESISTOR 4.7K 1/16W 5% T 1608	2	R205.208
C	05B-473-9Z	CHIP RESISTOR 47K 1/16W 5% T 1608	1	R204
C	060-104-9Z	CHIP RESISTOR 100K 1/10W 5% T 2012	1	RL202
C	130-A75-8Y	CHIP CERAMIC 0.001UF GRM39 X7R102K 50V P	4	C201.216.217 .220
C	131-091-7Y	CHIP CERAMIC 1PF GRM39 COG010C 50V P	2	C204.205
C	131-834-2Y	CHIP CERAMIC 18PF GRM39 COG180J 50V P	1	C215
C	132-024-2Y	CHIP CERAMIC 2PF GRM39 COG020C 50V P	1	C206
C	132-025-3Y	CHIP CERAMIC 20PF GRM39 COG200J 50V P	1	C203
C	132-260-8Y	CHIP CERAMIC 220PF GRM39 COG221J 50V P	1	C209
C	132-734-0Y	CHIP CERAMIC 27PF GRM39 COG270J 50V P	1	C212
C	133-348-0Y	CHIP CERAMIC 3.3PF GRM39 COG3R3C 50V P	1	C211
C	134-012-1Y	CHIP CERAMIC 4PF GRM39 COG040C 50V P	1	C218
C	134-756-0Y	CHIP CERAMIC 4.7PF GRM39 COG4R7C 50V P	1	C213
C	139-006-1Y	CHIP CERAMIC 9PF GRM426COG090D200V P	1	C208
C	200-067-3	TRANSISTOR 2SC5084-O	2	Q201.202
C	202-095-8Z	TRANSISTOR KRC104SND	1	Q203
C	242-025-7	DIODE VARACTOR CHIP HVU300ATRU 30V	1	D201
C	242-027-9	DIODE VARICAP CHIP 1SV217	1	D202
C	243-080-1	DIODE SI CHIP 1SS314	1	D203
C	311-070-4	COIL CHIP 0.18UH:NL252018T-R18J	1	L205
C	311-080-3	COIL CHIP 1.2UH:NL252018T-1R2J	2	L201.206
C	311-083-6	COIL CHIP 2.2UH:NL252018T-2R2J	1	L204
C	311-117-4	COIL CORE CHIP E558CN-100022	1	L203
C	406-764-C	P.C.B VCO 21X18X0.8 FR4 1/1	1	
C	772-428	SHIELD CAN(VCO) NSP T0.2	1	

8.4.5 V2 Front End

Category	Code & Part No.	Description	Qty	Location
C	05B-181-5Z	CHIP RESISTOR 180 1/16W 5% T 1608	1	R602
C	05B-229-6Z	CHIP RESISTOR 2.2 1/16W 5% T 1608	1	R604
C	05B-332-5Z	CHIP RESISTOR 3.3K 1/16W 5% T 1608	2	R601.605
C	05B-821-0Z	CHIP RESISTOR 820 1/16W 5% T 1608	1	R603
C	130-A75-8Y	CHIP CERAMIC 0.001UF GRM39 X7R102K 50V P	2	C616.620
C	131-093-9Y	CHIP CERAMIC 100PF GRM39 COG101J 50V P	2	C601.615
C	131-241-6Y	CHIP CERAMIC 120PF GRM39 COG121J 50V P	1	C609
C	131-405-8Y	CHIP CERAMIC 14PF GRM39 COG140J 50V P	1	C603
C	131-575-8Y	CHIP CERAMIC 150PF GRM39 COG151J 50V P	1	C611
C	132-025-3Y	CHIP CERAMIC 20PF GRM39 COG200J 50V P	1	C619
C	133-103-5Y	CHIP CERAMIC 30PF GRM39 COG300J 50V P	1	C606
C	133-349-1Y	CHIP CERAMIC 33PF GRM39 COG330J 50V P	1	C618
C	134-757-1Y	CHIP CERAMIC 47PF GRM39 COG470J 50V P	1	C612
C	136-209-3Y	CHIP CERAMIC 62PF GRM39 COG620J 50V P	1	C610
C	137-509-9Y	CHIP CERAMIC 75PF GRM39 COG750J 50V P	1	C608
C	203-181-7	TRANSISTOR MMBR951:SOT23	1	Q601
C	243-049-4Z	DIODE CHIP KDS226	1	D601
C	311-065-0	COIL CHIP 0.068UH:NL252018T-068J	1	L601
C	311-066-1	COIL CHIP 0.082UH:NL252018T-082J	1	L602
C	311-960-8	COIL SPRING 0.26X0.9X8T:L 26NH	4	L604.605.607 .608
C	406-765-B	P.C.B FRONT-END 27 X10 X0.8 FR4 1/1	1	
C	772-427	SHIELD CAN(FRONT-ENDNSP T0.2	1	

8.5 SL100 UHF Parts List

8.5.1 U2 Control Circuit

Category	Code & Part No.	Description	Qty	Location
C	05B-000-5Z	CHIP RESISTOR 0 1/16W 5% T 1608	11	RLK4.7.8.11. 15.22.26. LK29.30.33.3 4
	05B-100-2Z	CHIP RESISTOR 10 1/16W 5% T 1608	1	R466
	05B-102-4Z	CHIP RESISTOR 1K 1/16W 5% T 1608	1	R490
	05B-103-5Z	CHIP RESISTOR 10K 1/16W 5% T 1608	4	R403.413.430 .440
	05B-104-6Z	CHIP RESISTOR 100K 1/16W 5% T 1608	11	R409.420.454 .455.456.457. 458. 459.460.461. 472
	05B-105-7Z	CHIP RESISTOR 1M 1/16W 5% T 1608	2	R408.445
	05B-124-4Z	CHIP RESISTOR 120K 1/16W 5% T 1608	5	R405.428.436 .441.486
	05B-152-9Z	CHIP RESISTOR 1.5K 1/16W 5% T 1608	1	R416
	05B-154-1Z	CHIP RESISTOR 150K 1/16W 5% T 1608	1	R(LK18)
	05B-202-1Z	CHIP RESISTOR 2K 1/16W 5% T 1608	1	R435
	05B-203-2Z	CHIP RESISTOR 20K 1/16W 5% T 1608	3	R422.491.492
	05B-204-3Z	CHIP RESISTOR 200K 1/16W 5% T 1608	2	R423.438
	05B-220-7Z	CHIP RESISTOR 22 1/16W 5% T 1608	2	R477.482
	05B-222-9Z	CHIP RESISTOR 2.2K 1/16W 5% T 1608	2	R424.483
	05B-223-0Z	CHIP RESISTOR 22K 1/16W 5% T 1608	3	R412.470.RL K27
	05B-224-1Z	CHIP RESISTOR 220K 1/16W 5% T 1608	2	R404.464
	05B-273-5Z	CHIP RESISTOR 27K 1/16W 5% T 1608	3	R425.427.429
	05B-331-4Z	CHIP RESISTOR 330 1/16W 5% T 1608	1	R484
	05B-334-7Z	CHIP RESISTOR 330K 1/16W 5% T 1608	2	R471.488
	05B-472-8Z	CHIP RESISTOR 4.7K 1/16W 5% T 1608	3	R401.443.444
	05B-473-9Z	CHIP RESISTOR 47K 1/16W 5% T 1608	13	R407.410.411 .415.419.432. 433. 450.451.467. 473.474.475
	05B-513-2	CHIP RESISTOR 51K 1/16W 5% T 1608	3	R418.421.489
	05B-561-5Z	CHIP RESISTOR 560 1/16W 5% T 1608	1	R402
	05B-682-1Z	CHIP RESISTOR 6.8K 1/16W 5% T 1608	1	R406
	05B-683-2Z	CHIP RESISTOR 68K 1/16W 5% T 1608	1	R426
	05B-752-1Z	CHIP RESISTOR 7.5K 1/16W 5% T 1608	1	R487
	05B-823-2Z	CHIP RESISTOR 82K 1/16W 5% T 1608	1	R493
	130-A01-7Y	CHIP CERAMIC 0.015UF GRM39 X7R153K 25V P	1	C494
	130-A49-5Y	CHIP CERAMIC 0.0018UF GRM39 X7R182K 50V P	1	C495
	130-A73-6Y	CHIP CERAMIC 0.01UF GRM39 X7R103K 25V	1	C402
	130-A74-7Y	CHIP CERAMIC 0.1UF GRM39 Y5V104Z 25V P	10	C401.408.422 .423.431.451. 452, 453, 486, 490
	130-A75-8Y	CHIP CERAMIC 0.001UF GRM39 X7R102K 50V P	2	C415.445
	130-A99-0Y	CHIP CERAMIC 0.012UF GRM39 X7R123K 25V P	1	C436
	130-249-9	CHIP CERAMIC 0.0022UF GRM39 X7R222J 50V P	1	C418
	130-261-9Y	CHIP CERAMIC 0.022UF GRM39 X7R223K 50V P	1	C421

Category	Code & Part No.	Description	Qty	Location
	130-340-7Y	CHIP CERAMIC 0.0033UF GRM39 X7R332K 50V P	1	C432
	130-432-7Y	CHIP CERAMIC 0.0047UF GRM39 X7R472K 50V P	2	C488.489
	130-529-2	CHIP CERAMIC 0.056UF GRM39 X7R563K 16V	1	C444
	130-624-4	CHIP CERAMIC 0.68UF GRM40 Y5V684Z 16V P	1	C425
	131-089-7Y	CHIP CERAMIC 1UF GRM40 Y5V105Z 16V P	3	C433.434.435
	131-089-9Y	CHIP CERAMIC 1UF GRM426Y5V105Z 16V P	1	C416
	131-100-6Y	CHIP CERAMIC 0.1UF GRM39 X7R104K 50V P	5	C403.404.414 .427.487
	131-564-8Y	CHIP CERAMIC 15PF GRM39 COG150J 50V P	2	C428.429
	132-260-8Y	CHIP CERAMIC 220PF GRM39 COG221J 50V P	5	C438.439.440 .441.493
	134-770-2Y	CHIP CERAMIC 470PF GRM39 X7R471K 50V P	9	C405.407.410 .411.412.413. 419.437.447
	136-840-2Y	CHIP CERAMIC 680PF GRM39 X7R681K 50V P	1	C424
	141-052-5Z	CHIP TANTALUM 100UF 293D107X0006E2T6V	1	C442
	141-059-2	CHIP TANTALUM 10UF 293D106X06R3A2T6.3V	4	C406.420.430 .454
	144-720-0Z	CHIP TANTALUM 4.7UF 293D475X0020C2T20V	1	C443
	144-722-2Z	CHIP TANTALUM 4.7UF 293D475X0010A2T10V	5	C417.446.450 .491.492
	202-085-9Z	TRANSISTOR KRC101SNA	1	Q402
	202-092-5	BRT KRA110SPK	1	Q401
	202-095-8Z	TRANSISTOR KRC104SND	6	Q404.406.40 8.414.415.41 6
	202-106-5	TRANSISTOR KTA1504SY	1	Q405
	218-039-1Z	TRANSISTOR KRA101S	1	Q403
	221-196-7	I.C EEPROM X25330SI (SOIC8PIN)	1	IC404
	221-203-0	I.C AUDIO AMP TDA7233D (SO-8)	1	IC402
	221-204-1	I.C OTP HD6473837UX	1	IC403
	221-492-4	I.C ASIC MSIMXA	1	IC406
	222-018-5A	I.C KIA324F-EL	1	IC408
	223-224-9	I.C MC14066BDR2:SO14	1	IC401
	231-064-4	I.C OP AMP LM358MX	1	IC407
	243-051-5	DIODE SI CHIP KDS184S	1	D404
	243-052-6	DIODE SI CHIP KDS193	1	D403
	243-063-6	DIODE SWITCHING KDS181S A3	2	D401.402
	262-775-7	CRYSTAL CHIP 3.579545M 50PM 12P	1	X401
	310-659-2	COIL CHIP 10UH:LER015T100K	1	L401
	4A6-090-E	P.C.B ASS'Y 125.1X113 X1.0 FR4 2/S	1	
	406-767-B	P.C.B LCD 20.7 X15 X1.0 FR4 2/S	1	
	416-097-E	P.C.B DIGITAL 101.1X55.5 X1.0 FR4 2/S	1	
	420-771-3	JACK MINIATURE HSJ-0861-01-410	1	J401
	421-203-2	CONNECTOR DF15(6.2)-30DP-0.65V(51)	1	CON404
	422-470-1	CONNECTOR WAFFER 53048-0410 1.25W/B	1	CON401
	436-046-5	SW TACT SKPT-1101VA	3	SW402.403.4 05

8.5.2 U2 RF

Category	Code & Part No.	Description	Qty	Location
	05B-000-5Z	CHIP RESISTOR 0 1/16W 5% T 1608	3	R124.LK3.D903
	05B-100-2Z	CHIP RESISTOR 10 1/16W 5% T 1608	2	R79.908
	05B-101-3Z	CHIP RESISTOR 100 1/16W 5% T 1608	7	R11.15.28.66.88.97.130
	05B-102-4Z	CHIP RESISTOR 1K 1/16W 5% T 1608	4	R54.71.86.94
	05B-103-5Z	CHIP RESISTOR 10K 1/16W 5% T 1608	8	R1.53.82.98.103.104.106.111
	05B-104-6Z	CHIP RESISTOR 100K 1/16W 5% T 1608	1	R2
	05B-105-7Z	CHIP RESISTOR 1M 1/16W 5% T 1608	1	R50
	05B-122-2Z	CHIP RESISTOR 1.2K 1/16W 5% T 1608	2	R37.55
	05B-123-3Z	CHIP RESISTOR 12K 1/16W 5% T 1608	3	R17.42.45
	05B-152-9Z	CHIP RESISTOR 1.5K 1/16W 5% T 1608	2	R63.96
	05B-180-4Z	CHIP RESISTOR 18 1/16W 5% T 1608	3	R25.34.26
	05B-181-5Z	CHIP RESISTOR 180 1/16W 5% T 1608	1	R56
	05B-182-6Z	CHIP RESISTOR 1.8K 1/16W 5% T 1608	4	R4.5.7.22
	05B-183-7Z	CHIP RESISTOR 18K 1/16W 5% T 1608	2	R83.84
	05B-202-1Z	CHIP RESISTOR 2K 1/16W 5% T 1608	1	R6
	05B-220-7Z	CHIP RESISTOR 22 1/16W 5% T 1608	5	R23.24.41.64.89
	05B-222-9Z	CHIP RESISTOR 2.2K 1/16W 5% T 1608	5	R3.18.46.901.902
	05B-223-0Z	CHIP RESISTOR 22K 1/16W 5% T 1608	7	R67.68.76.77.102.105.112
	05B-224-1Z	CHIP RESISTOR 220K 1/16W 5% T 1608	1	R72
	05B-271-3Z	CHIP RESISTOR 270 1/16W 5% T 1608	1	R110
	05B-272-4Z	CHIP RESISTOR 2.7K 1/16W 5% T 1608	7	R13.14.78.81.92.150.151
	05B-273-5Z	CHIP RESISTOR 27K 1/16W 5% T 1608	2	R905.907
	05B-301-7Z	CHIP RESISTOR 300 1/16W 5% T 1608	4	R29.30.31.32
	05B-332-5Z	CHIP RESISTOR 3.3K 1/16W 5% T 1608	2	R52.95
	05B-390-7Z	CHIP RESISTOR 39 1/16W 5% T 1608	1	R59
	05B-391-8Z	CHIP RESISTOR 390 1/16W 5% T 1608	1	R10
	05B-393-0Z	CHIP RESISTOR 39K 1/16W 5% T 1608	1	R85
	05B-471-7Z	CHIP RESISTOR 470 1/16W 5% T 1608	2	R91.909
	05B-472-8Z	CHIP RESISTOR 4.7K 1/16W 5% T 1608	2	R27.903
	05B-473-9Z	CHIP RESISTOR 47K 1/16W 5% T 1608	2	R75.100
	05B-474-0Z	CHIP RESISTOR 470K 1/16W 5% T 1608	4	R58.69.70.87
	05B-475-1Z	CHIP RESISTOR 4.7M 1/16W 5% T 1608	1	R135
	05B-510-9Z	CHIP RESISTOR 51 1/16W 5% T 1608	1	R65
	05B-512-1Z	CHIP RESISTOR 5.1K 1/16W 5% T 1608	1	R20
	05B-513-2	CHIP RESISTOR 51K 1/16W 5% T 1608	1	R19
	05B-562-6Z	CHIP RESISTOR 5.6K 1/16W 5% T 1608	3	R9.12.35
	05B-682-1Z	CHIP RESISTOR 6.8K 1/16W 5% T 1608	1	R33
	05B-752-1Z	CHIP RESISTOR 7.5K 1/16W 5% T 1608	2	R904.906

Category	Code & Part No.	Description	Qty	Location
	05B-911-8Z	CHIP RESISTOR 910 1/16W 5% 1608	2	R8.16
	05C-104-6Z	CHIP RESISTOR 100K 1/16W 1% T 1608	2	R57.99
	05C-683-2Z	CHIP RESISTOR 68K 1/16W 1% T 1608	2	R61.62
	06F-108-3	CHIP RESISTOR 0.1 1W 1% 1218	1	R109
	060-153-3Z	CHIP RESISTOR 15K 1/10W 5% T 2012	1	R116
	060-243-1Z	CHIP RESISTOR 24K 1/10W 5% T 2012	1	R74
	075-102-5	RES.CHIP TRIMMER K RH03E1C13X	2	RV2.4
	075-103-6	RES.CHIP TRIMMER 10K RH03E1C14X	2	RV1.3
	098-333-8	THERMISTOR CHIP 33K:NTCCS32163SH333KC	1	TH1
	101-058-9	ELECT CAPACITOR 10UF 16V 20% 3X5	1	C129
	130-A17-6Y	CHIP CERAMIC 0.001UF GRM40 X7R102K 50V P	1	C68
	130-A48-4Y	CHIP CERAMIC 0.0015UF GRM39 X7R152K 50V P	1	C108
	130-A60-4Y	CHIP CERAMIC 0.1UF GRM40 X7R104K 25V P	4	C79.102.111.113
	130-A73-6Y	CHIP CERAMIC 0.01UF GRM39 X7R103K 25V	17	C13.27.63.96.106,14,6,23,6,7.131.901-904.910.911
	130-A74-7Y	CHIP CERAMIC 0.1UF GRM39 Y5V104Z 25V P	8	C11.15.17.26.30.88.195.907
	130-A75-8Y	CHIP CERAMIC 0.001UF GRM39 X7R102K 50V P	7	C18.98.104.122.145.164.194
	130-341-8Y	CHIP CERAMIC 0.033UF GRM39 X7R333K 16V P	1	C112
	130-443-7	CHIP CERAMIC 0.47UF GRM40 Y5V474Z 16V P	1	C59
	131-039-1Y	CHIP CERAMIC 10PF GRM40 COG100C 50V P	1	C74
	131-089-7Y	CHIP CERAMIC 1UF GRM40 Y5V105Z 16V P	7	C14.25.28.29.70.94.192
	131-092-8Y	CHIP CERAMIC 10PF GRM39 COG100D 50V P	2	C107.121
	131-093-9Y	CHIP CERAMIC 100PF GRM39 COG101J 50V P	1	C52
	131-100-6Y	CHIP CERAMIC 0.1UF GRM39 X7R104K 50V P	2	C48.124
	131-240-5Y	CHIP CERAMIC 12PF GRM39 COG120J 50V P	3	C10.83.90
	131-405-8Y	CHIP CERAMIC 14PF GRM39 COG140J 50V P	1	C92
	131-511-0Y	CHIP CERAMIC 15PF GRM40 COG150J 50V P	1	C38
	131-834-2Y	CHIP CERAMIC 18PF GRM39 COG180J 50V P	2	C905.906
	132-259-8Y	CHIP CERAMIC 22PF GRM39 COG220J 50V P	1	C87
	132-260-8Y	CHIP CERAMIC 220PF GRM39 COG221J 50V P	28	C19.31.37.45.47.54.115.146.165.190.191.303.304.307-311. + 314.316.319.321-323.325-328

Category	Code & Part No.	Description	Qty	Location
	132-266-4Y	CHIP CERAMIC 2.2PF GRM40 COG2R2C 50V P	1	C72
	132-714-2Y	CHIP CERAMIC 27PF GRM40 COG270J 50V P	1	C42
	133-349-1Y	CHIP CERAMIC 33PF GRM39 COG330J 50V P	2	C118.908
	133-350-1Y	CHIP CERAMIC 330PF GRM39 COG331J 50V P	1	C9
	134-012-1Y	CHIP CERAMIC 4PF GRM39 COG040C 50V P	1	C32
	134-757-1Y	CHIP CERAMIC 47PF GRM39 COG470J 50V P	4	C105.117.163 .166
	134-761-4Y	CHIP CERAMIC 470PF GRM40 COG471J 50V P	1	C77
	134-767-0Y	CHIP CERAMIC 4.7PF GRM40 COG4R7C 50V P	1	C75
	134-770-2Y	CHIP CERAMIC 470PF GRM39 X7R471K 50V P	22	C1.3.4.7.8.20. 33.34.55.57.5 8. 61,2,6,7.78.8 0- 82.84.103.31 8
	135-021-4Y	CHIP CERAMIC 5PF GRM39 COG050C 50V P	1	C46
	136-005-5Y	CHIP CERAMIC 6PF GRM40 COG060D 50V P	1	C41
	136-014-3Y	CHIP CERAMIC 6PF RM39 COG060D 50V P	3	C16.51.56
	137-007-1Y	CHIP CERAMIC 7PF GRM40 COG070D 50V P	1	C36
	138-004-4Y	CHIP CERAMIC 8PF GRM40 COG080D 50V P	1	C73
	138-011-0Y	CHIP CERAMIC 8PF GRM39 COG080D 50V P	1	C43
	138-232-3Y	CHIP CERAMIC 82PF GRM39 COG820J 50V P	1	C93
	141-046-0Z	CHIP TANTALUM 10UF 293D106X0010B2T10V	1	C65
	141-059-2	CHIP TANTALUM 10UF 293D106X06R3A2T6.3V	2	C2.12
	144-722-2Z	CHIP TANTALUM 4.7UF 293D475X0010A2T10V	5	C6.53.60.95.1 28
	180-126-6	METAL POLY CAP 0.01UF 103K 63V BOX	2	C23.24
	180-209-8	METAL POLY CAP 0.022UF 223K 63V BOX	1	C22
	180-301-7	METAL POLY CAP 0.33UF 334K 63V BOX	1	C21
	200-003-5	TRANSISTOR BFR92A REEL	2	Q17.25
	200-113-1	TRANSISTOR KTC4075	4	Q901.903.90 4.905
	200-114-2	TRANSISTOR KTA2014	1	Q902
	202-092-5	BRT KRA110SPK	4	Q2.4.9.32
	202-095-8Z	TRANSISTOR KRC104SND	6	Q12.18.23.24 .28.260
	202-106-5	TRANSISTOR TA1504SY	2	Q7.8
	202-113-1	TRANSISTOR KTC3875S(BL)	7	Q6.11.14.19. 21.26.27
	202-116-4	TRANSISTOR KTA1663	1	Q22
	203-181-7	TRANSISTOR MMBR951:SOT23	2	Q3.16
	218-057-7Z	TRANSISTOR KRA104S	2	Q1.5
	220-028-4	I.C REGULATOR K11450MTR	1	IC1
	221-325-7	POWER MPDULE(UHF) M68732H(GNOK-M68732H-E26)	1	IC9
	221-529-5	I.C PLL MC145193F (SO-20)	1	IC2
	223-453-9	I.C FM IF MC3372D (SO-16) (MOB.80	1	IC5
	231-064-4	I.C OP AMP LM358MX	1	IC3
C	243-012-0	DIODE MMBV3401LT1	2	D21.25
	243-049-4Z	DIODE CHIP KDS226	2	D901.902
	243-052-6	DIODE SI CHIP DS193	2	D8.16
	243-063-6	DIODE SWITCHING KDS181S A3	2	D13.14
	243-087-8	DIODE CHIP UPP9401(T&R)50V 2.5W	2	D5.6
	243-122-6	SCHOTTKY DIODE HSMS-2817 #L31	1	D9
	245-040-5	DIODE REC CHIP SM4004 1A 400V SMD	1	D2
	263-418-0	CRYSTAL NR2D 44.645M -30 15PM 32P 3R	1	X1

Category	Code & Part No.	Description	Qty	Location
	270-109-9	FILTER CERAMIC CFWM455F	1	CF1
	270-314-7	DISCRIMINATOR CDBC455CX16-TC	1	X2
	270-316-9	FILTER CERAMIC LTWM455HT	1	CF2
	271-165-4	CRYSTAL FILTER 45Y15BN 45.1MHZ	1	XF1
	280-110-2	FUSE 60 V 4 A 25NM-040-L REEL:SM	1	FUSE1
	300-223-8	TRANSFORMERS CHIP 617PT-1019	2	T1.2
	310-659-2	COIL CHIP 10UH:LER015T100K	1	L19
	310-859-6	COIL CHIP 18NH:LL2012-F18NM	5	L1.2.3.4.5
	311-069-4	COIL CHIP 0.15UH:NL252018T-R15J	1	L15
	311-077-1	COIL CHIP 0.68UH:NL252018T-R68J	1	L14
	311-078-2	COIL CHIP 0.82UH:NL252018T-R82J	1	L6
	311-079-3	COIL CHIP 1.0UH:NL252018T-1R0J	1	L18
	311-167-9	COIL SPRING X0.35X7T:R	1	L13
	311-170-1	COIL CHIP 1000UH:300SS-102K=CP3	2	L16.17
	311-301-3	COIL SPRING 2X0.75X3T:L SMD	3	L7.8.11
	416-096-C	P.C.B RF 99 X53.3 X1.0 FR4 2/S	1	
	420-417-8	ANT NSB83-H400-MX75	1	
	421-204-3	CONNECTOR DF15(0.8)-30DS-0.65V(51)	1	J1
	422-930-0	SPRING CONNECTOR GW9803302	2	CON1.9
	450-528-0	VR 20KA TP76NOON	1	VR5

8.5.3 TCXO

	05B-102-4Z	CHIP RESISTOR 1K 1/16W 5% T 1608	1	R10
	05B-103-5Z	CHIP RESISTOR 10K 1/16W 5% T 1608	1	R9
	05B-104-6Z	CHIP RESISTOR 100K 1/16W 5% T 1608	2	R13.15
	05B-122-2Z	CHIP RESISTOR 1.2K 1/16W 5% T 1608	1	R1
	05B-152-9Z	CHIP RESISTOR 1.5K 1/16W 5% T 1608	1	R16
	05B-154-1Z	CHIP RESISTOR 150K 1/16W 5% T 1608	1	R4
	05B-203-2Z	CHIP RESISTOR 20K 1/16W 5% T 1608	1	R2
	05B-393-0Z	CHIP RESISTOR 39K 1/16W 5% T 1608	1	R5
	05B-473-9Z	CHIP RESISTOR 47K 1/16W 5% T 1608	4	R7.8.12.14
	05B-563-7Z	CHIP RESISTOR 56K 1/16W 5% T 1608	2	R6.11
	05B-564-8Z	CHIP RESISTOR 560K 1/16W 5% T 1608	1	R3
	097-103-6	THERMISTER CHIP 10K NTCCM20123NH103JCT	1	TH1
	097-473-6	THERMISTOR CHIP NTCCM 16084LH 473JC 47K	1	TH2
	130-A74-7Y	CHIP CERAMIC 0.1UF GRM39 Y5V104Z 25V P	1	C3
	131-137-6Y	CERAMIC CHIP 100PF GRM39 U2J101J 50V	1	C2
	131-564-8Y	CHIP CERAMIC 15PF GRM39 COG150J 50V P	1	C1
	132-275-2	CHIP CERAMIC 22PF GRM39 U2J220J 50V P	1	C5
	132-735-1Y	CHIP CERAMIC 270PF GRM39 COG271J 50V P	1	C6
	134-012-1Y	CHIP CERAMIC 4PF GRM39 COG040C 50V P	1	C4
	172-021-1	TRIMMER 20PF TZC03P200A110	1	CT1
	202-082-6	TRANSISTOR KTA1504ST1(G)	1	Q2
	202-112-0	TRANSISTOR KTC3875S(GR)	2	Q3.4
	202-153-7	TRANSISTOR KTC3880SY	1	Q1
	242-011-4	DIODE VARICAP MMBV109	1	D1
	242-025-7	DIODE VARACTOR CHIP HVU300ATRU 30V	1	D2
	263-374-3	CRYSTAL CA303HS 12.8MHZ 3PPM 14PF	1	X1 "B"RANK FOR LMR TCXO
	406-785-A	P.C.B TCXO 19X11X0.8T FR4	1	
	772-429	SHIELD CAN(TCXO) BSP T0.25 NI-PLATE	1	
	860-172	PIN TCXO PIN BRASS TIN PLATED	4	PIN
	906-542	INSULATION PLATE FIBER T0.3	1	

8.5.4 VCO

05B-101-3Z	CHIP RESISTOR 100 1/16W 5% T 1608	1	R202
05B-103-5Z	CHIP RESISTOR 10K 1/16W 5% T 1608	1	R201
05B-104-6Z	CHIP RESISTOR 100K 1/16W 5% T 1608	1	R203
05B-183-7Z	CHIP RESISTOR 18K 1/16W 5% T 1608	1	R205
05B-221-8Z	CHIP RESISTOR 220 1/16W 5% T 1608	1	R209
05B-222-9Z	CHIP RESISTOR 2.2K 1/16W 5% T 1608	2	R206.207
05B-472-8Z	CHIP RESISTOR 4.7K 1/16W 5% T 1608	1	R208
05B-473-9Z	CHIP RESISTOR 47K 1/16W 5% T 1608	1	R204
130-A75-8Y	CHIP CERAMIC 0.001UF GRM39 X7R102K 50V P	1	C214
130-515-9Y	CHIP CERAMIC 0.5PF GRM39 COG0R5C 50V P	1	C206
130-704-3Y	CHIP CERAMIC 0.75PF GRM39 COG0R75C50V P	1	C204
131-092-8Y	CHIP CERAMIC 10PF RM39 COG100D 50V P	2	C203.212
131-563-7Y	CHIP CERAMIC 1.5PF GRM39 COG1R5C 50V P	1	C205
132-260-8Y	CHIP CERAMIC 220PF GRM39 COG221J 50V P	5	C201.209.216 .217.220
133-102-4Y	CHIP CERAMIC 3PF GRM39 COG030C 50V P	2	C213.218
134-012-1Y	CHIP CERAMIC 4PF GRM39 COG040C 50V P	2	C207.211
137-013-7Y	CHIP CERAMIC 7PF GRM39 COG070D 50V P	1	C215
176-012-3	CHIP TRIMMER 6PF TZC03Z060A110	1	C208
200-067-3	TRANSISTOR 2SC5084-O	2	Q201.202
202-095-8Z	TRANSISTOR KRC104SND	1	Q203
242-022-4	DIODE VARICAP CHIP 1SV229	2	D201.202
243-080-1	DIODE SI CHIP SS314	1	D203
311-051-7	COIL CHIP 0.033UH:NL252018T-033J	1	L205
311-067-2	COIL CHIP 0.1UH:NL252018T-R10J	2	L201.206
311-075-9	COIL CHIP 0.47UH:NL252018T-R47J	1	L202
311-078-2	COIL CHIP 0.82UH:NL252018T-R82J	1	L204
311-218-2	COIL CHIP VCOOSC1.2T E558AN-100040-P3	1	L203
406-764-C	P.C.B VCO 21X18X0.8 FR4 1/1	1	
772-428	SHIELD CAN(VCO) NSP T0.2	1	
05B-101-3Z	CHIP RESISTOR 100 1/16W 5% T 1608	1	R602
05B-563-7Z	CHIP RESISTOR 56K 1/16W 5% T 1608	1	R601
131-092-8Y	CHIP CERAMIC 10PF GRM39 COG100D 50V P	2	C602.611
131-240-5Y	CHIP CERAMIC 12PF GRM39 COG120J 50V P	1	C608
131-405-8Y	CHIP CERAMIC 14PF GRM39 COG140J 50V P	1	C610
131-604-1Y	CHIP CERAMIC 16PF GRM39 COG160J 50V P	1	C607
133-102-4Y	CHIP CERAMIC 3PF GRM39 COG030C 50V P	1	C606
133-348-0Y	CHIP CERAMIC 3.3PF GRM39 COG3R3C 50V P	3	C601.604.612
134-012-1Y	CHIP CERAMIC 4PF GRM39 COG040C 50V P	2	C605.614
134-770-2Y	CHIP CERAMIC 470PF GRM39 X7R471K 50V P	1	C603
135-631-5Y	CHIP CERAMIC 5.6PF GRM39 COG5R6C 50V P	1	C613
136-014-3Y	CHIP CERAMIC 6PF GRM39 COG060D 50V P	1	C609
200-067-3	TRANSISTOR 2SC5084-O	1	Q601
243-049-4	DIODE SI CHIP KDS226	1	D601
311-943-3	COIL SPRING 14NH 03095TL	2	L605.606
311-944-4	COIL SPRING 10.5NH 03094TR	5	L601.602.603 .604.607
406-787-A	P.C.B FRONT-END 27 X10 X0.8 FR4 1/1	1	
772-427	SHIELD CAN(FRONT-ENDNSP T0.2	1	

9 CIRCUIT DIAGRAMS & PCB LAYOUTS

The following Circuit Schematics and PCB Layouts are included:

P416097	Digital PCB
P416096c	RF PCB
P406787a	Front End
P406764c	VCO
P496785a	TCXO

Larger circuit diagrams are available to order, if required.

This Service Manual and the circuit diagrams are available to Dealers / Distributors on the Maxon Intranet Web Site.

P416097c Digital Board Top

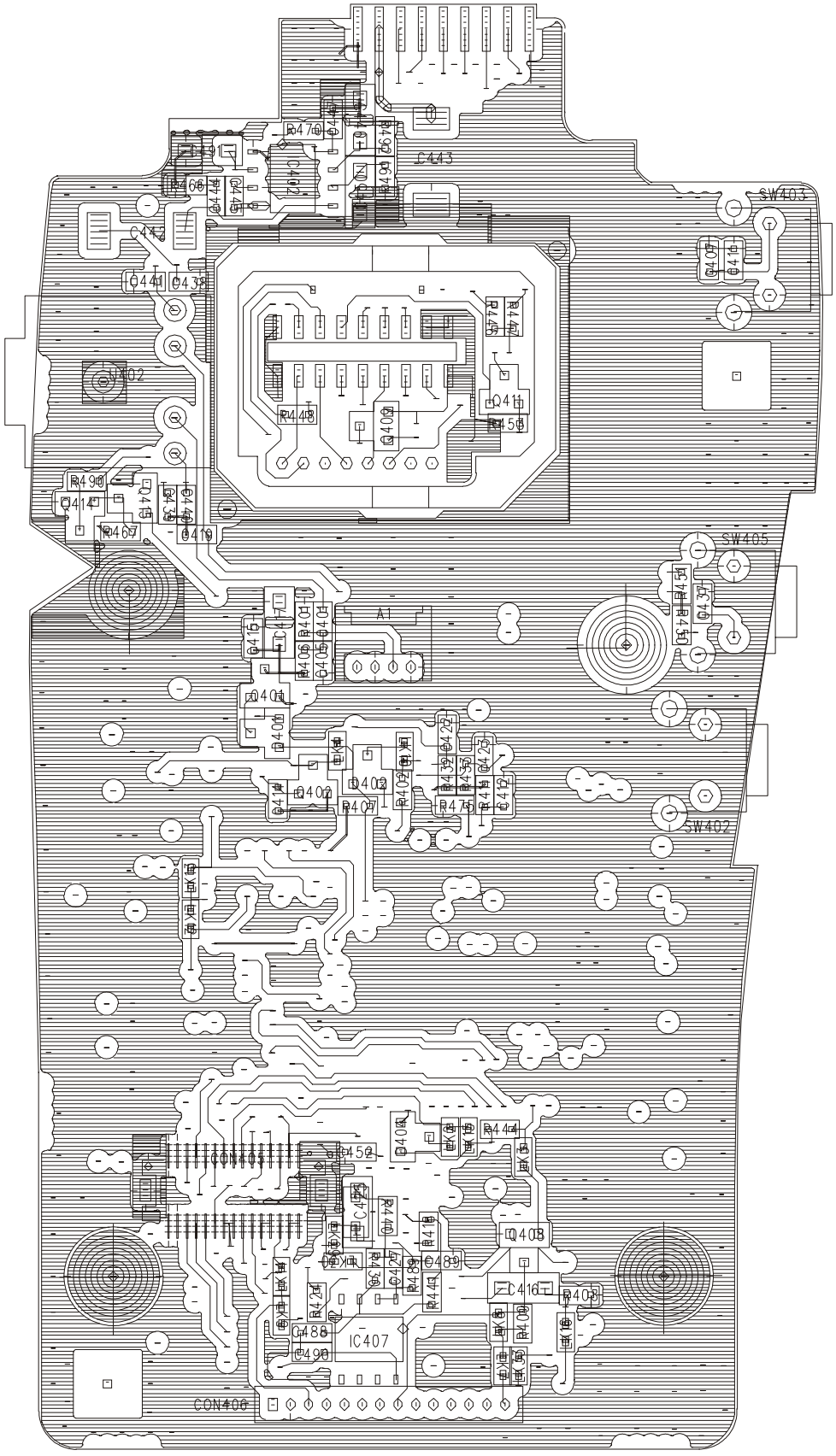


Figure 9-1 – Digital Board Layout Top Side

P416097c Digital Board Bottom

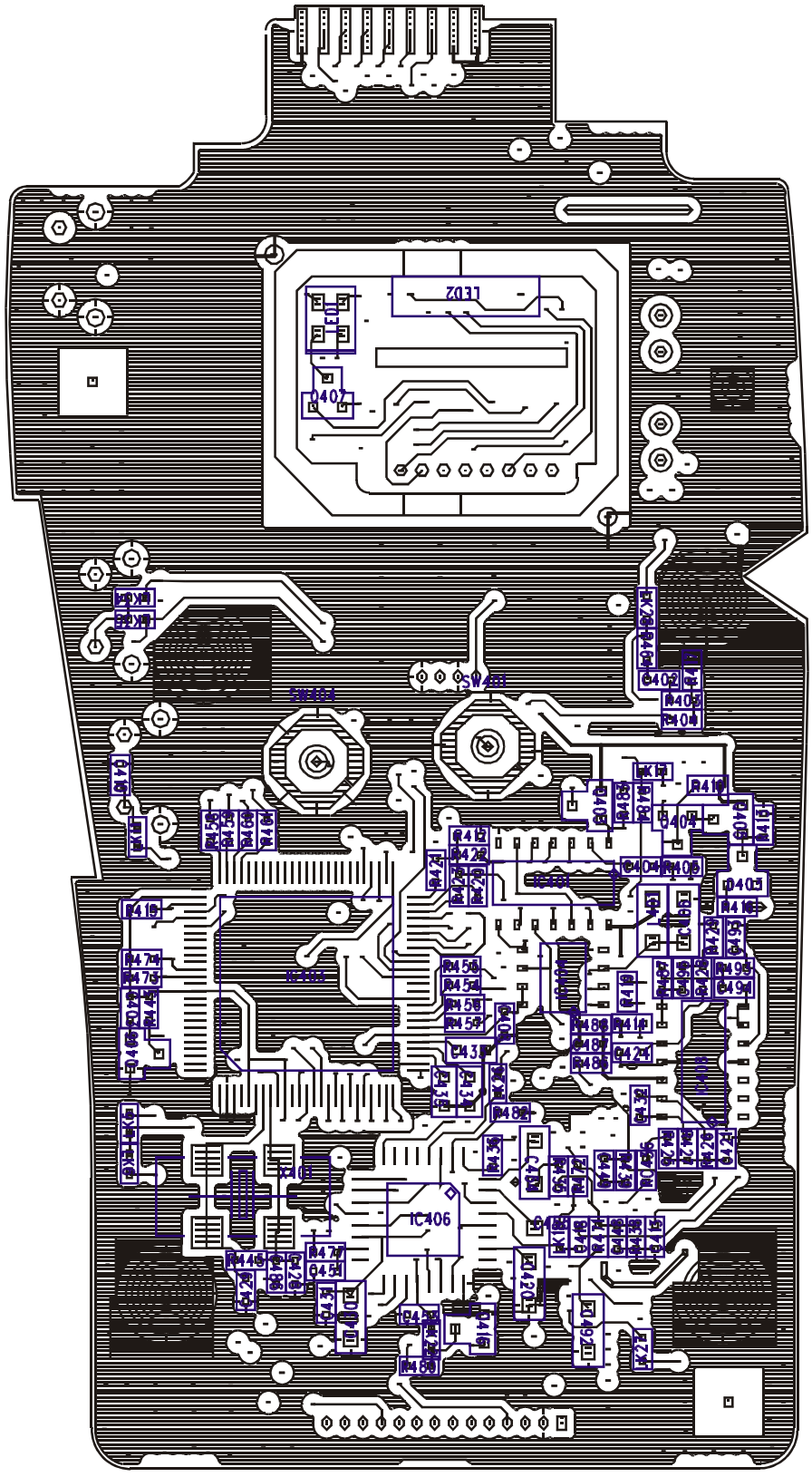


Figure 9-2 - Digital Board Layout Bottom Side

P416096c RF PCB Top (V2)

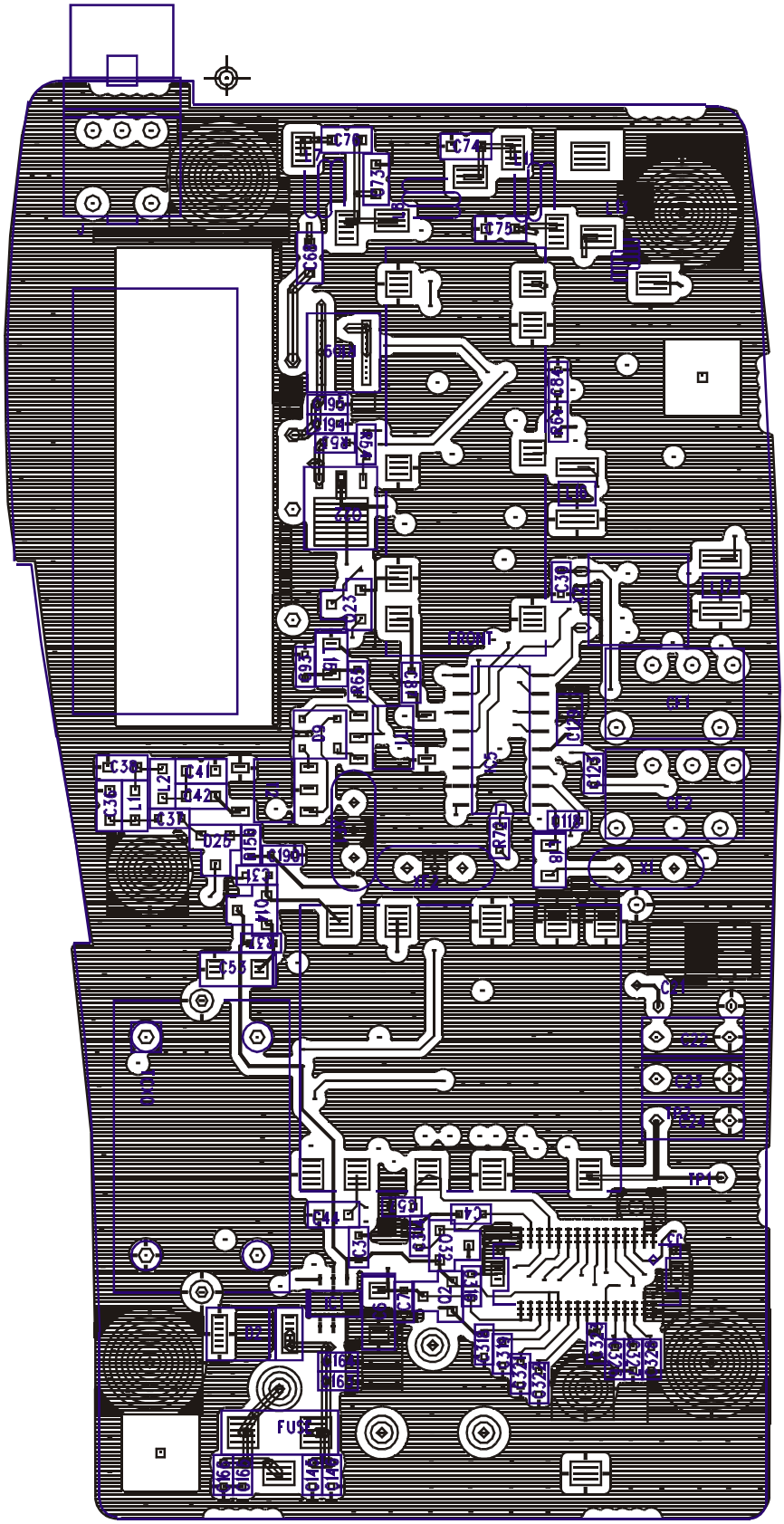


Figure 9-3 - RF Board Layout Top Side

P416096c RF PCB Bottom Side (V2)

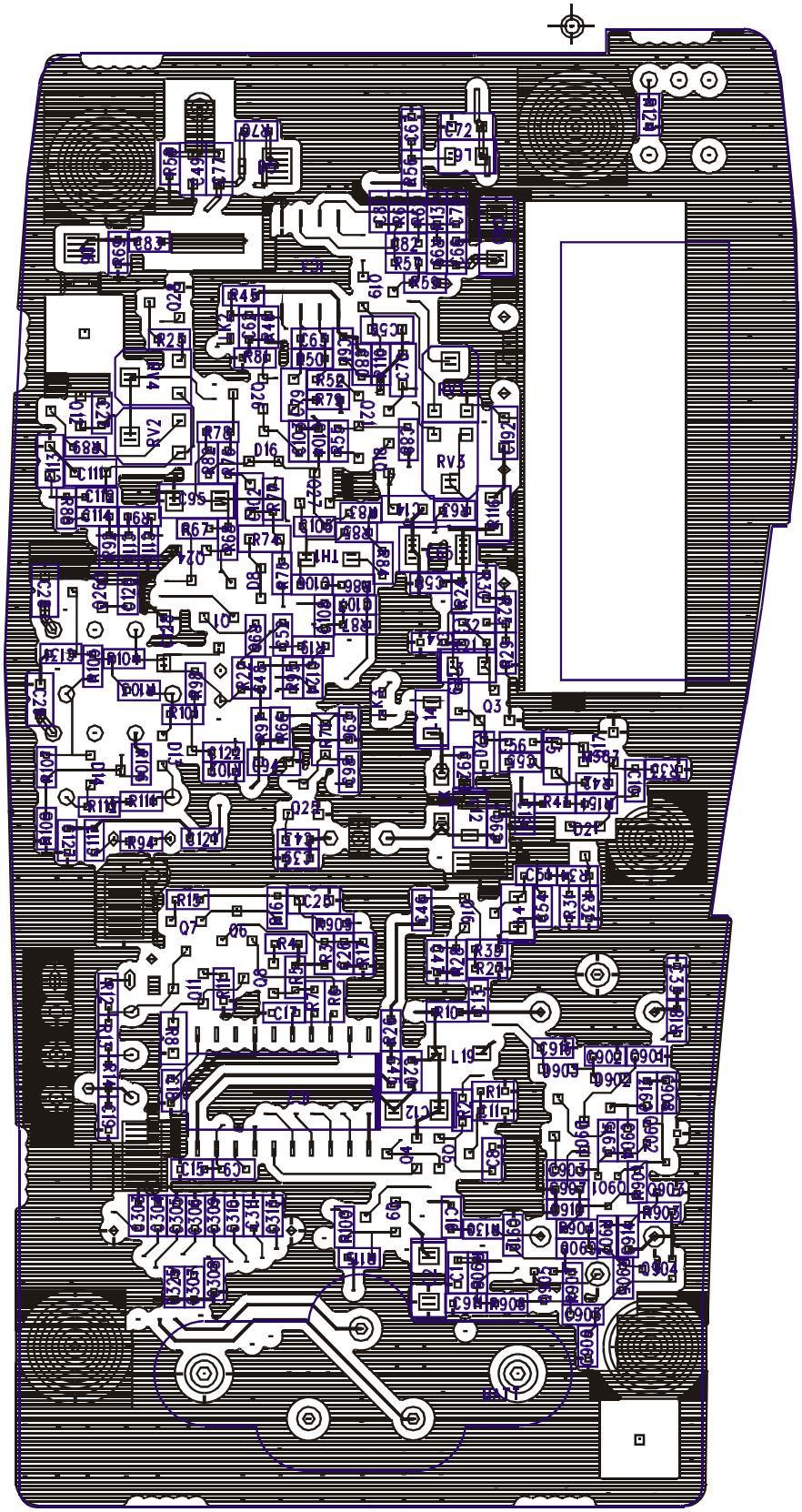


Figure 9-4 - RF Board Layout Bottom Side

P406787a Front End

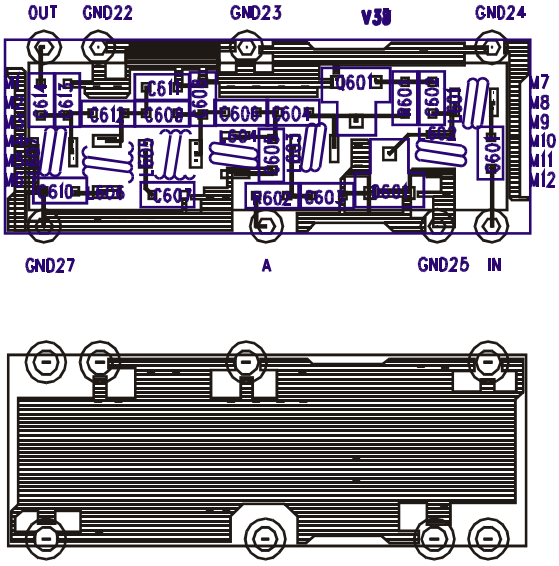


Figure 9-5 – Front-End Board Layout

P406764c VCO PCB

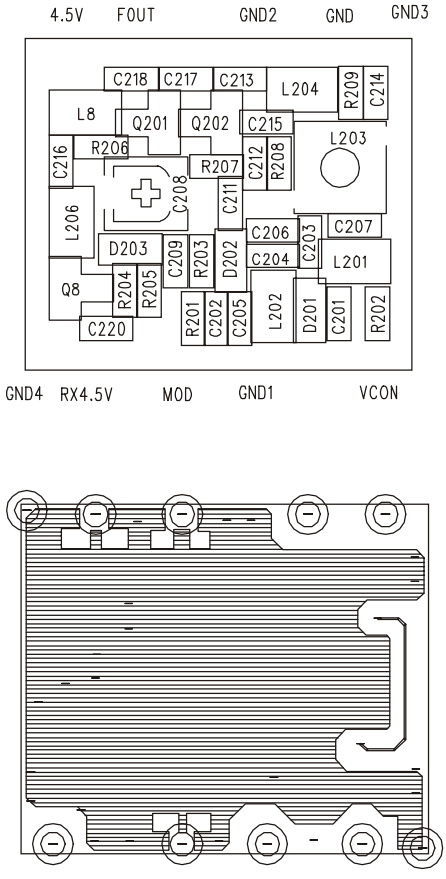


Figure 9-6 – VCO Board Layout

P496785a TCXO PCB

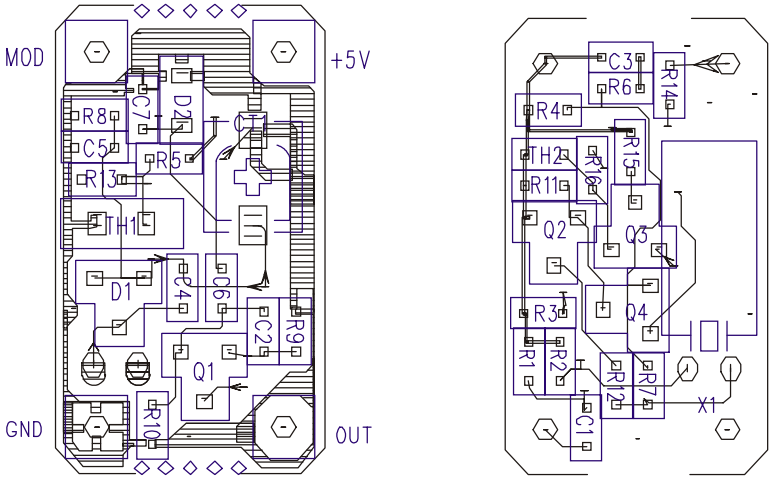


Figure 9-7 – TCXO Board Layout

10 SPARE PARTS

10.1 Spare Parts

The following items only are held as replacement parts for the SL100.

Category	Code & Part No.	Description	Drawing Reference
A	56858-CCA	Control Circuit Assembly (V2)	
A	56858-FV2	V2 Front End Assembly	
A	56858-LCD	LCD Module V2	
A	56858-RCA	V2 RF Circuit Assembly	
A	56858-TCXO	V2 TCXO Assembly	
A	56858-VV2	V2 VCO Assembly	
A	56859-CCA	Control Circuit Assembly (U2)	
A	56859-FU2	U2 Front End Assembly	
A	56859-LCD	LCD Module U2	
A	56859-RCA	UHF RF Circuit Assembly	
A	56859-TCXO	U2 TCXO Assembly	
A	56859-VU2	U2 VCO Asembly	
A	508751	Channel Up/Down Switches	
A	508726-AA	Upper Cover Assembly	1
A	508727-BA	Back Cover Assembly	
B	612-081	Screw	29
B	612-306	Screw	65
B	772-427	Front End Shield Can	32
B	772-462	Shield Can (Power module)	30
B	772-496	Shield Can (Control pcb)	74
B	772-497	Shield Can (RF pcb)	75
B	826-393	Knob Volume	12
B	826-396	Belt Clip Holder Assembly	59,60,64
B	895-544	PTT Pad	10
B	895-545	Up/Down Key Pad	4
B	895-546	Accesory Socket Dust Cap	2
B	895-547	Option Key	9
B	895-557	Gasket	6
B	895-660	Cushion	73
B	895-661	Cushion	66
B	895-685	Cushion for mic	72
B	895-753	Rubber Cap	
B	895-754	O-ring (Antenna)	
B	895-763	Connector O-ring (Antenna)	
B	906-706	Felt	15
B	906-929	Plate	
B	937-498	Owner’s Manual	
B	280-110-2	Fuse	
B	420-125-1	Speaker	17
B	420-206-0	Microphone (condenser)	19
B	420-771-3	Jack (3.5mm stereo connector)	22
B	421-197-0	Antenna connector	
B	421-203-2	Connector (CON404 - between boards)	
B	421-204-3	Connector (CON404 – between boards)	
B	422-470-1	Connector	
B	422-930-0	Spring connector	40
B	436-046-5	Switch Tact	
B	450-528-0	Volume Potentiometer	
B	CA-7959	Belt Clip	

See Maxon Dealer Web Pages for additional items and pricing.

10.1.1 Component Replacement

Surface mount components

Surface mount components should always be replaced using a temperature controlled soldering system.

The soldering tools may be either a temperature controlled soldering iron or a temperature controlled hot-air soldering station.

A hot-air system is recommended for the removal of components on the multi-layered boards used in the radio.

With either soldering system, the component manufacturer's recommended temperature should be maintained.
The following procedures outline the removal and replacement of surface mount components. If a hot-air soldering system is employed, see the manufacturer's operating instructions for detailed information on the use of your system.

CAUTION: Avoid applying heat to the body of any surface mount component using standard soldering method. Heat should be applied only to the metalised terminals of the components. Hot-air systems do not damage the components since the heat is quickly and evenly distributed to the external surface of the component.

CAUTION: The CMOS integrated circuit devices used in this equipment can be destroyed by static discharges.

Before handling any of these devices, service technicians should discharge themselves by touching the case of a bench test instrument that has a 3-prong power cord connected to an outlet with a known good earth ground.

When soldering or desoldering a CMOS device, the soldering equipment should have a known good earth ground.

Surface mount removal

1. Grip the component with tweezers or sill needle nose pliers.

2. Alternately heat the metalised terminal ends of the surface mount component with the soldering iron. If a hot-air system is used, direct the heat to the terminals of the component.

Use extreme care with the soldering equipment to prevent damage to the printed circuit board (PCB) and the surrounding components.

3. When the solder on all terminals is liquefied, gently remove the component. Excessive force may cause the PCB pads to separate from the board if all solder is not completely liquefied.

4. It may be necessary to remove excess solder using a vacuum de-soldering tool or solder wick. Again, use great care when de- soldering or soldering on the printed circuit boards.

It may be necessary to remove the epoxy adhesive that was under the surface mount component and any flux on the PCB.

Surface mount component replacement

1. "Tin" one terminal end of the new component and the corresponding pad of the PCB. Use as little solder as possible.

2. Place the component on the PCB pads, observing proper orientation for capacitors, diodes, transistors, etc.

3. Simultaneously touch the "tinned" terminal end and the "tinned" pad with the soldering iron. Slightly press the component down on the board as the solder liquefies.

Solder all terminals, allowing the component time to cool between each application of heat.

Do not apply heat for an excessive length of time and do not use excessive solder.

With a hot-air system, apply hot air until all "tinned" areas are melted and the component is seated in place. It may be necessary to slightly press the component down on the board.

Touch-up the soldered connections with a standard soldering iron as needed. Do not use excessive solder.

CAUTION: Some chemicals may damage the internal and external plastic parts of the radio.

4. Allow the component and the board to cool and then remove all flux from the area using alcohol or another approved flux remover.

Surface mounted integrated circuit replacement

Soldering and de-soldering techniques of the surface mounted IC's are similar to the above outlined procedures for the surface mounted chip components.

Use extreme care and observe static precautions when removing or replacing the defective (or suspect) IC's. This will prevent any damage to the printed circuit board or the surrounding circuitry.

The hot-air soldering system is the best method of replacing surface mount IC's. The IC's can -easily be removed and installed using the hot-air system. See the manufacturer's instructions for complete details on tip selection and other operating instructions unique to your system.
If a hot-air systems is not available, the service technician may wish to clip the pins near the body of the defective IC and remove it. The pins can then be removed from the PCB with a standard iron and tweezers, and the new IC installed following the Surface Mount Component Replacement procedures.

Provided that the IC is relatively new, It will not be necessary to 'tin', all (or any) of the IC pins before the installation process.

If the IC has been in stock for some time, cleaning, and tinning of the pins may be necessary.

11 APPENDIX – ACC-2003 ALIGNMENT BOX

11.1 Purpose

This Section is reproduced from the ACC-2003 User Guide and provides information on the operation of the ACC-2003 Interface Test Jig.
This jig is used for the Service adjustment of the SP200/210 radio.

The Calibration program (Calibration.exe) is used to allow the setting of ASIC conditions within the radio.

Default ASIC conditions can be programmed into a radio and then repeated from radio to radio.

For non-ATE conditions, such as Repair or Adjustment, the various parameters can be manually adjusted.

11.2 Test Equipment

A Standard Radio Communication Test Set, oscilloscope and 7.5V Power supply are required.

11.3 Calibration Program

11.3.1 Operation

Ensure that the Power Switch is OFF on the Interface box. Switch on the S200/210 and place the volume control at the half-way position.

Place the ATE/MANUAL switch in the ATE position (switch down). Place the Audio EN switch in the ON position (switch down) and PTT off. Switch the Test Jig on by operating the on/off switch.

The letter ‘A’ should be displayed on the SP200/210.

On the PC, start the Calibration.exe program. Figure 11-1 should be displayed.

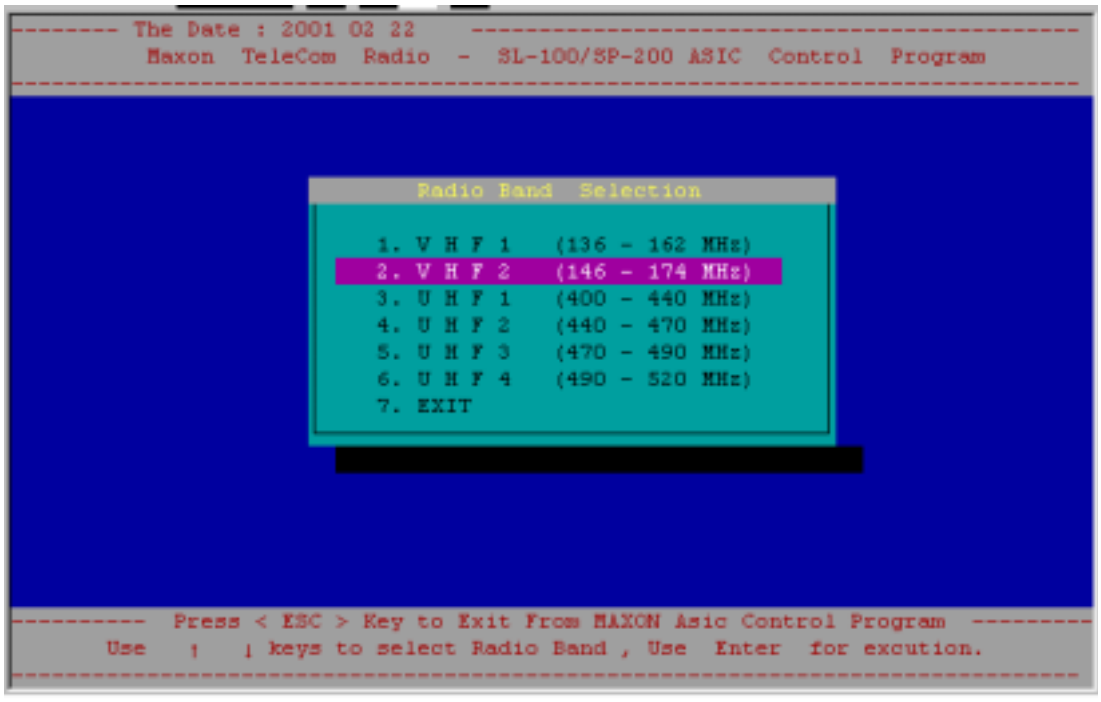


Figure 11-1 – Calibration Program Initial Screen

Select the required band and press Enter. Figure 11-2 will be displayed.

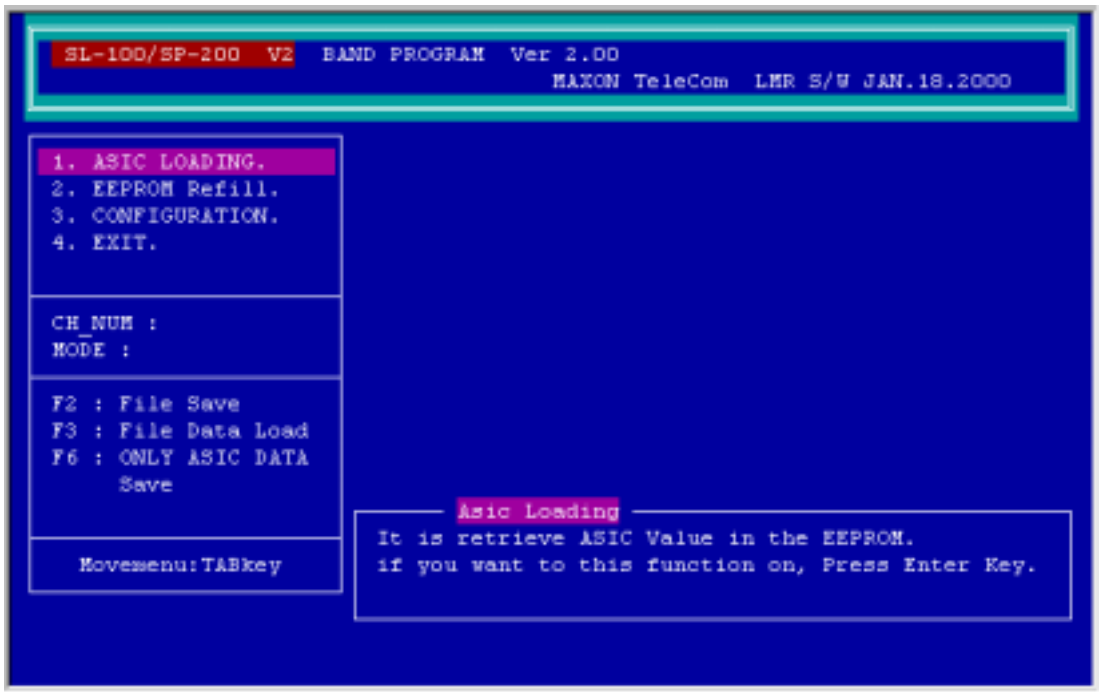


Figure 11-2 - Calibration Program Primary Screen

To dedicate the Communication Port, select Configuration and enter the relevant port number.

Selecting EEPROM loading will retrieve the current ASIC values, stored in the radio. This is used for the alignment of the radio. This selection should not be made if the EEPROM is empty (new EEPROM) or if the radio is in the middle of another operation.

If there is a Communications error, check the setting BEFORE turning the power on at the Interface Box.

Press ‘ESC’ at error message and then ‘N’ to try again.

To write default values (see Default Settings) select ‘EEPROM’ Refill. This writes the default ASIC values and the default frequencies.

To program the radio with the altered ASIC values, press F6.

Note: If the channel shows ‘Unlock’ under the PLL status (top right) this implies that the channel does not have a valid frequency programmed into the radio. This will also occur if the start-up sequence is not observed, see Section 11.1.

If writing is in progress, ASIC CONTROL will be displayed, see Figure 11-3.

See Section 11.4 for default ASIC values; these may alter depending upon Production requirements.

Figure 11-3 - ASIC Control Screen (Rx)

11.3.2 Adjustment of ASIC values

With the ASIC Control screen open, use the TAB key on the PC keyboard to tab along until the required parameter is highlighted.

Note; Only parameters within the Rx or Tx mode can be accessed.

Once the required parameter is highlighted, make adjustments using the PgUp and PgDn keys on the PC keyboard.

For the transmitter, the following parameters can be adjusted (see Figure 11-4):

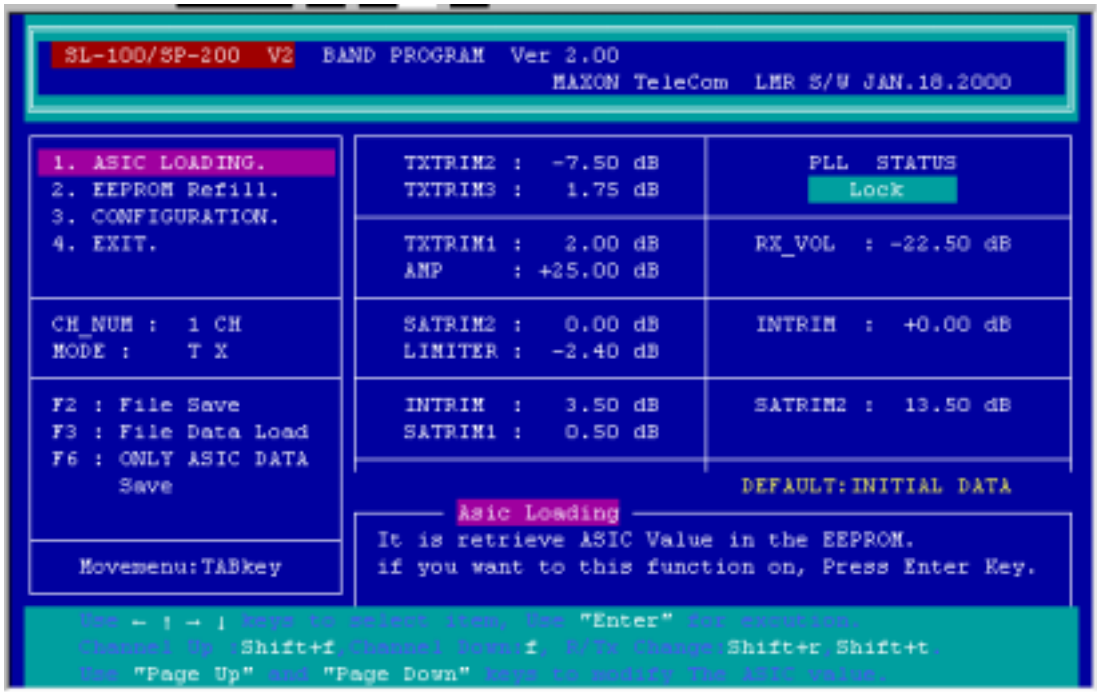


Figure 11-4 - ASIC Control Screen (Tx)

TXTRIM2

Adjusts the audio gain to the VCO in 0.25dB steps from –11dB to –3.25dB.

TXTRIM3

Adjusts the audio gain to the TCXO in 0.25dB steps from –4.0dB to +3.75dB.

TXTRIM1

Adjusts the overall audio deviation in 0.5dB steps from –4.0 to +3.5dB.

AMP

Adjusts the gain of the limiting amplifier in 3.3dB steps from 0dB to +3.5dB.

SATRIM2

Adjusts the SAT tone deviation in 0.5dB steps from –3 to +2.5dB.

LIMITER

Adjusts the limited audio in 1.8dB steps from –7.8dB to –2.4dB.

INTRIM

Adjusts the Mic audio in 0.5dB steps from -4dB to +3.5dB.

SATRIM1

Adjust the signal amplitude of DTMF in 0.5dB step from 0dB to 7.5dB

For the receiver the following parameters can be adjusted (see Figure 11-5):

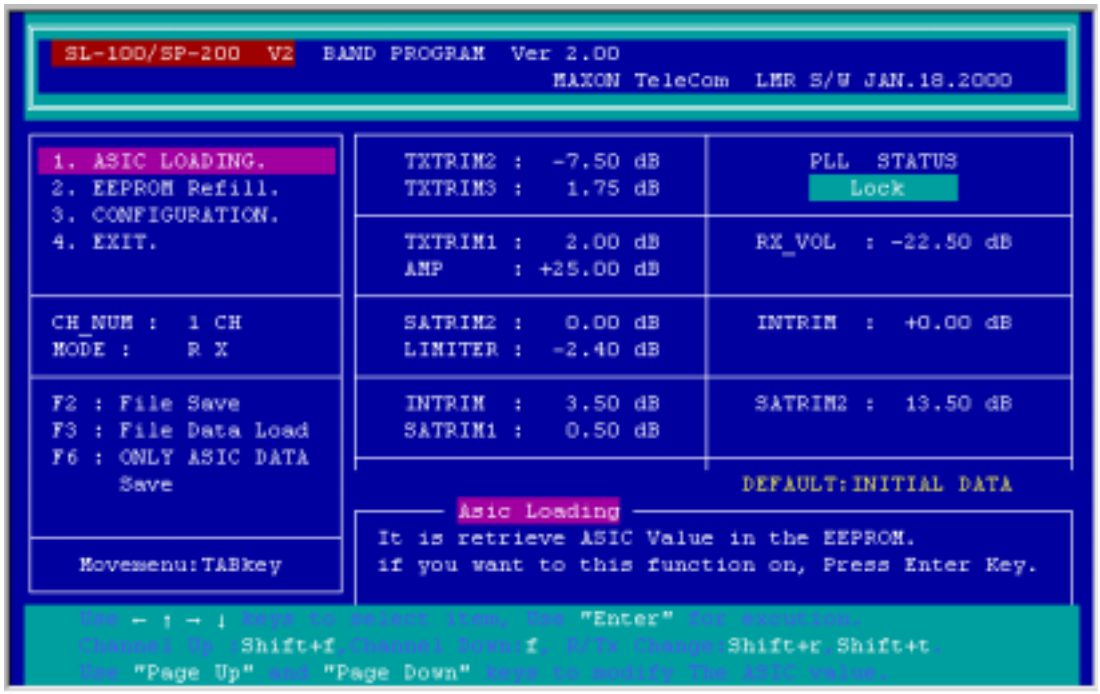


Figure 11-5 - ASIC Control Screen (Rx)

INTRIM

Adjusts the demodulated audio at IF IC in 0.5dB steps from -4dB to +3.5dB.

SATRIM2

Adjusts the SAT tone received level in 0.5dB steps from +12 to +13.5dB.

RX VOL

Adjusts the received audio level to the audio IC in 2.5dB steps from mute to –37.5dB.

To write to EEPROM: Press F6 for ASIC data ONLY.
Press F5 for ASIC & Frequency data

Press ‘ESC’ to finish the program and close the window.

11.3.3 Transmit Adjustments

The transmit mode is entered by pressing SHIFT + T on the keyboard.

Ensure that the Power Supply is set to +7.5V.

11.3.3.1 Power Adjustment

The power level is set by the potentiometers on the back plate of the radio, they are located underneath the Type Approval label. **Note**: A spare label is shipped with every radio.

Refer to the Service Manual for the correct procedure for setting the power levels. With the ASIC program operating, the channel can be altered by using the “F” key.

11.3.3.2 SAT Balance

Set Audio Generator to 400Hz, 300mV (20dB above nominal level). Adjust TXTRIM2/TXTRIM3 to make demodulated signal as shown in Figure 11-6.

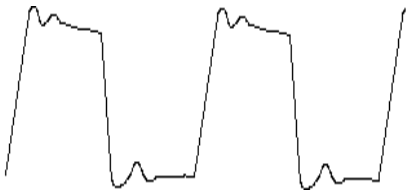


Figure 11-6 - Modulation wave shape

11.3.3.3 Audio Deviation Limits

Use Channel 2. Turn the SAT tone off and input an audio level (1kHz) at 20dB above nominal. Check that the peak deviation is between 2.0 and 2.15kHz at 12.5kHz channel spacing or between 4.0 and 4.3kHz for 25kHz channel spacing.

TXTRIM1 can be used to adjust the audio deviation. Check at frequencies across the band.

Any other adjustments are covered earlier on in this Service Manual.

11.3.3.4 SAT Deviation

Input a SAT tone, with no MIC level. Check that the tone deviation is between 300 and 350Hz at 12.5kHz channel spacing or 650 to 700Hz tone deviation at 25kHz channel spacing.

SATRIM2 can be used to adjust the SAT deviation. Check at frequencies across the band.

11.3.4 Receive Adjustments

The receive mode is entered by pressing SHIFT + R on the keyboard.

Ensure that the power supply is set to +7.5V.

11.3.4.1 Audio Output Level

Set Test Set RF level to –47dBm, with 1kHz audio modulation at 20dB above nominal. Set the volume control to maximum and adjust RX_VOL to generate 2.2Vrms audio output level.

Any other adjustments are covered earlier on in this Service Manual.

11.4 Default Settings

11.4.1 V1 Band Default Settings

CH	RX	OPTION	TX	OPTION	N/S	POWER
1ch	136.025MHz	No	136.075MHz	No	S Band	High
2ch	138.025MHz	No	138.075MHz	No	S Band	High
3ch	145.025MHz	No	145.075MHz	No	S Band	High
4ch	150.025MHz	No	150.075MHz	No	S Band	High
5ch	160.025MHz	No	160.075MHz	No	S Band	High
6ch	136.025MHz	No	136.075MHz	No	N Band	Low
7ch	138.025MHz	No	138.075MHz	No	N Band	Low
8ch	145.025MHz	No	145.075MHz	No	N Band	Low
9ch	150.025MHz	No	150.075MHz	No	N Band	Low
10ch	160.025MHz	No	160.075MHz	No	N Band	Low
11ch	145.025MHz	67Hz(CTCSS)	145.075MHz	67Hz	S Band	High
12ch	145.025MHz	100Hz	145.075MHz	100Hz	S Band	High
13ch	145.025MHz	250.3Hz	145.075MHz	250.3Hz	S Band	High
14ch	145.025MHz	67Hz	145.075MHz	67Hz	N Band	Low
15ch	145.025MHz	100Hz	145.075MHz	100Hz	N Band	Low
16ch	145.025MHz	250.3Hz	145.075MHz	250.3Hz	N Band	Low
17ch	145.025MHz	023(DCS)	145.075MHz	023	S Band	High
18ch	145.025MHz	306	145.075MHz	306	S Band	High
19ch	145.025MHz	754	145.075MHz	754	S Band	High
20ch	145.025MHz	023	145.075MHz	023	N Band	Low
21ch	145.025MHz	306	145.075MHz	306	N Band	Low
22ch	145.025MHz	754	145.075MHz	754	N Band	Low

Table 3 – V1 Default Frequency Table

ASIC Settings for V1

TX		RX	
TXTRIM 2	-8.0	RX_VOL	-20
TXTRIM 3	1.25	INTRIM	0.0
TXTRIM 1	1.5	SATRIM 2	13.5
AMP	25		
SATRIM 2	2.0		
LIMITER	-2.4		
INTRIM	0.0		
SATRIM1	2		

Table 4 – V1 Default ASIC Settings

11.4.2 V2 Band Default Settings

CH	RX	OPTION	TX	OPTION	N/S	POWER
1ch	146.025MHz	No	146.075MHz	No	S Band	High
2ch	155.025MHz	No	155.075MHz	No	S Band	High
3ch	160.025MHz	No	160.075MHz	No	S Band	High
4ch	168.025MHz	No	168.075MHz	No	S Band	High
5ch	173.025MHz	No	173.075MHz	No	S Band	High
6ch	146.025MHz	No	146.075MHz	No	N Band	Low
7ch	155.025MHz	No	155.075MHz	No	N Band	Low
8ch	160.025MHz	No	160.075MHz	No	N Band	Low
9ch	168.025MHz	No	168.075MHz	No	N Band	Low
10ch	173.025MHz	No	173.075MHz	No	N Band	Low
11ch	155.025MHz	67Hz(CTCSS)	155.075MHz	67Hz	S Band	High
12ch	155.025MHz	100Hz	155.075MHz	100Hz	S Band	High
13ch	155.025MHz	250.3Hz	155.075MHz	250.3Hz	S Band	High
14ch	155.025MHz	67Hz	155.075MHz	67Hz	N Band	Low
15ch	155.025MHz	100Hz	155.075MHz	100Hz	N Band	Low
16ch	155.025MHz	250.3Hz	155.075MHz	250.3Hz	N Band	Low
17ch	155.025MHz	023(DCS)	155.075MHz	023	S Band	High
18ch	155.025MHz	306	155.075MHz	306	S Band	High
19ch	155.025MHz	754	155.075MHz	754	S Band	High
20ch	155.025MHz	023	155.075MHz	023	N Band	Low
21ch	155.025MHz	306	155.075MHz	306	N Band	Low
22ch	155.025MHz	754	155.075MHz	754	N Band	Low

Table 5 – V2 Default Frequency Table

ASIC Settings for V2

TX		RX	
TXTRIM 2	-7.25	RX_VOL	-20
TXTRIM 3	1.75	INTRIM	0.0
TXTRIM 1	1.0	SATRIM 2	13.5
AMP	25		
SATRIM 2	1.0		
LIMITER	-2.4		
INTRIM	2.5		
SATRIM1	2		

Table 6 – V2 Default ASIC Settings

11.4.3 U1 Band Default Settings

CH	RX	OPTION	TX	OPTION	N/S	POWER
1ch	400.025MHz	No	400.075MHz	No	S Band	High
2ch	410.025MHz	No	410.075MHz	No	S Band	High
3ch	415.025MHz	No	415.075MHz	No	N Band	High
4ch	420.025MHz	No	420.075MHz	No	S Band	High
5ch	429.025MHz	No	429.075MHz	No	S Band	High
6ch	400.025MHz	No	400.075MHz	No	N Band	Low
7ch	410.025MHz	No	410.075MHz	No	N Band	Low
8ch	415.025MHz	No	415.075MHz	No	N Band	Low
9ch	420.025MHz	No	420.075MHz	No	N Band	Low
10ch	429.025MHz	No	429.075MHz	No	N Band	Low
11ch	415.025MHz	67Hz(CTCSS)	415.075MHz	67Hz	S Band	High
12ch	415.025MHz	100Hz	415.075MHz	100Hz	S Band	High
13ch	415.025MHz	250.3Hz	415.075MHz	250.3Hz	S Band	High
14ch	415.025MHz	67Hz	415.075MHz	67Hz	N Band	Low
15ch	415.025MHz	100Hz	415.075MHz	100Hz	N Band	Low
16ch	415.025MHz	250.3Hz	415.075MHz	250.3Hz	N Band	Low
17ch	415.025MHz	023(DCS)	415.075MHz	023	S Band	High
18ch	415.025MHz	306	415.075MHz	306	S Band	High
19ch	415.025MHz	754	415.075MHz	754	S Band	High
20ch	415.025MHz	023	415.075MHz	023	N Band	Low
21ch	415.025MHz	306	415.075MHz	306	N Band	Low
22ch	415.025MHz	754	415.075MHz	754	N Band	Low

Table 7 - U1 Default Frequency Table

TX		RX	
TXTRIM 2	-3.5	RX_VOL	-20
TXTRIM 3	-1	INTRIM	0.0
TXTRIM 1	1.5	SATRIM 2	13.5
AMP	25		
SATRIM 2	1.0		
LIMITER	-7.8		
INTRIM	0.5		
SATRIM1	0.5		

Table 8 - U1 Default ASIC Settings

11.4.4 U2 Band Default Settings

CH	RX	OPTION	TX	OPTION	N/S	POWER
1ch	440.025MHz	No	440.075MHz	No	S Band	High
2ch	450.025MHz	No	450.075MHz	No	S Band	High
3ch	455.025MHz	No	455.075MHz	No	N Band	High
4ch	460.025MHz	No	460.075MHz	No	S Band	High
5ch	469.025MHz	No	469.075MHz	No	S Band	High
6ch	440.025MHz	No	440.075MHz	No	N Band	Low
7ch	450.025MHz	No	450.075MHz	No	N Band	Low
8ch	455.025MHz	No	455.075MHz	No	N Band	Low
9ch	460.025MHz	No	460.075MHz	No	N Band	Low
10ch	469.025MHz	No	469.075MHz	No	N Band	Low
11ch	455.025MHz	67Hz(CTCSS)	455.075MHz	67Hz	S Band	High
12ch	455.025MHz	100Hz	455.075MHz	100Hz	S Band	High
13ch	455.025MHz	250.3Hz	455.075MHz	250.3Hz	S Band	High
14ch	455.025MHz	67Hz	455.075MHz	67Hz	N Band	Low
15ch	455.025MHz	100Hz	455.075MHz	100Hz	N Band	Low
16ch	455.025MHz	250.3Hz	455.075MHz	250.3Hz	N Band	Low
17ch	455.025MHz	023(DCS)	455.075MHz	023	S Band	High
18ch	455.025MHz	306	455.075MHz	306	S Band	High
19ch	455.025MHz	754	455.075MHz	754	S Band	High
20ch	455.025MHz	023	455.075MHz	023	N Band	Low
21ch	455.025MHz	306	455.075MHz	306	N Band	Low
22ch	455.025MHz	754	455.075MHz	754	N Band	Low

Table 9 – U2 Default Frequency Table

ASIC Settings for U2

TX		RX	
TXTRIM 2	-4.25	RX_VOL	-20
TXTRIM 3	-2.5	INTRIM	0.0
TXTRIM 1	2.0	SATRIM 2	13.5
AMP	28.5		
SATRIM 2	2.5		
LIMITER	-7.8		
INTRIM	0.0		
SATRIM1	1		

Table 10 – U2 Default ASIC Settings